THE BULLETIN

of the

AMERICAN ASSOCIATION

of

NURSE ANESTHETISTS

MAY

1941

VOLUME 9 NUMBER 2

Buy with Confidence

Because the quality of medical gases cannot be determined except by accurate chemical analysis and these products are purchased and used sight unseen, CONFIDENCE must be placed in the Manufacturer. Back of the "Puritan Maid" label on every cylinder, identifying the products of the Puritan Compressed Gas Corporation, is a reputation earned through many years of service to the Profession, during which time we have grown to be one of the largest producers of these products in the world.

Puritan Mask and Bag complete **$7.00**

Has had widespread acceptance and is known for effective, economical administration of therapeutic gases. Write for Illustrated Booklet "Puritan Gas Therapy Equipment."

SEE YOUR PURITAN DEALER OR WRITE OUR NEAREST OFFICE

PURITAN COMPRESSED GAS CORP.

BALTIMORE BOSTON CINCINNATI ST. PAUL DETROIT
CHICAGO ST. LOUIS KANSAS CITY NEW YORK
• Puritan Dealers in Most Principal Cities •

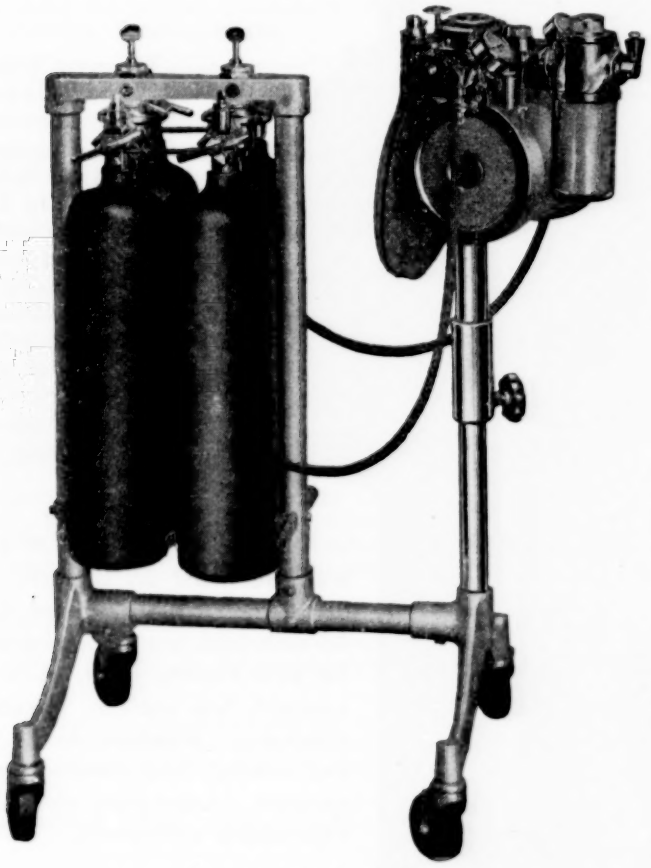
"PURITAN MAID" GASES AND GAS THERAPY EQUIPMENT

SIMPLE AS A-B-C

This automatic flow rate

OBSTETRICAL UNIT

is built especially for the inexperienced anesthetist in your O B department



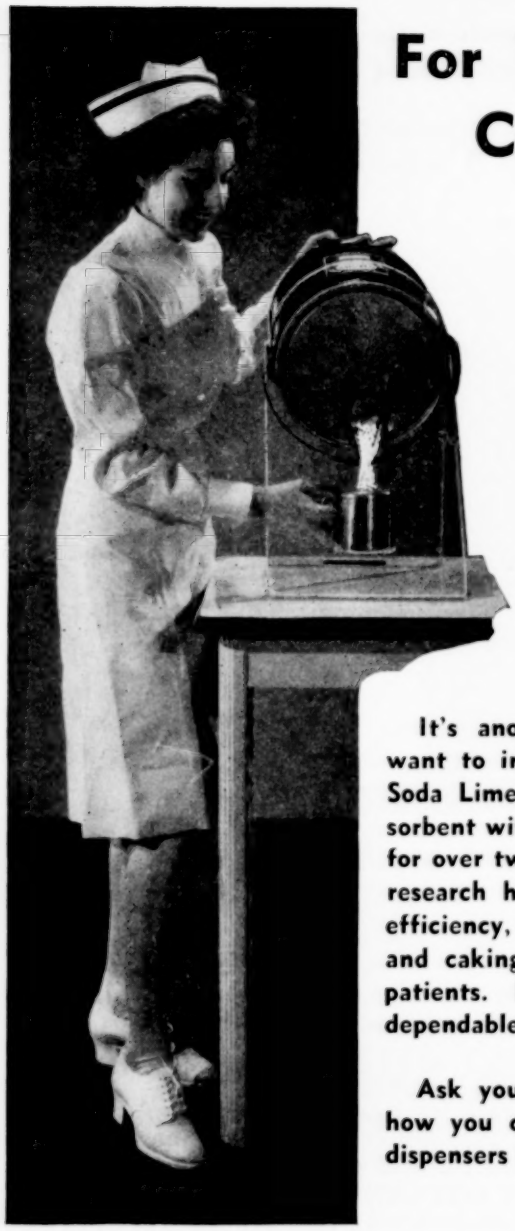
No. 928 O.B. Model L Unit

1 Only ONE dial to operate for mixture control
2 Can be ordered in unit that delivers never less than 10% oxygen
3 Fully AUTOMATIC flow rate for perfect analgesia
4 IMMEDIATE DIRECT OXYGEN
5 Can be set so gas mixture does not flow when mask is off the face
6 EFFICIENT Ether vaporizer
7 ECONOMICAL operation

SEVEN GOOD REASONS WHY YOU SHOULD REPLACE THAT OLD GAS EATER IN O B

Write us for literature or demonstration without obligation

McKESSON APPLIANCE COMPANY
TOLEDO OHIO



For Your Convenience

The new Wilson Soda Lime Dispenser makes it convenient as well as economical to buy Wilson Soda Lime in the thrifty 5-gallon pail. It's scientifically designed to hold the pail tightly, tip easily, and automatically return to an upright position. Now you can fill your canisters quickly and accurately, without lifting a heavy pail.

It's another reason why you'll want to insist on Genuine Wilson Soda Lime—the standard CO_2 absorbent with the medical profession for over twenty years. Continuous research has steadily improved its efficiency, freedom from heating and caking, and comfort for your patients. Laboratory controlled for dependable uniformity.

Ask your hospital supply house how you can secure one of these dispensers free of charge.

P.S. And have you seen the New Wilson INDICATOR Soda Lime that shows a sharp, definite color change from WHITE to VIOLET as absorbency is exhausted?

DEWEY AND ALMY CHEMICAL CO.
CAMBRIDGE, MASS.

BULLETIN OF THE AMERICAN ASSOCIATION OF NURSE ANESTHETISTS

The Bulletin of the American Association of Nurse Anesthetists is published by the American Association of Nurse Anesthetists; Executive, Editorial and Business Offices, 2065 Adelbert Road, Cleveland, Ohio.

Publishing Committee: Gertrude L. Fife, Chairman; Harriet L. Aberg, Rose G. Donavan, Barbara Brown.

Entered as second class matter February 6, 1937, at the Postoffice at Cleveland, Ohio, under the Act of March 3, 1879.

Published quarterly; subscription price—members 50¢ per year; non-members, $1.00 per year.

EDITORIAL COMMUNICATIONS

The Bulletin invites concise, original articles on anesthesia. Description of new technics and methods are welcomed. Articles are accepted for publication with the understanding that they are contributed solely to the Bulletin of the American Association of Nurse Anesthetists.

Manuscripts submitted for publication may be sent to Gertrude L. Fife, University Hospitals, Cleveland, Ohio.

The American Association of Nurse Anesthetists does not hold itself responsible for any statements or opinions expressed by any contributor in any article published in its columns.

Manuscripts. — Manuscripts should be typewritten on one side of the paper only, with double spacing and liberal margins. References should be placed at the end of the article and should conform to the following style: viz., name of author, title of article, and name of periodical with volume, page, and year.

Illustrations accompanying manuscripts should be numbered, provided with suitable legends, and marked on margin or back with the author's name, Authors should indicate on the manuscript the approximate position of text figures.

Illustrations — A reasonable number of half-tones will be reproduced free of cost to the author, but special arrangements must be made with the Chairman of the Publishing Committee for elaborate tables or extra illustrations.

Reprints. — Fifty or more reprints may be obtained at a nominal cost if ordered within fifteen days following the date of publication of the Bulletin.

BUSINESS COMMUNICATIONS

All communications in regard to advertising, subscriptions, change of address, et cetera, should be addressed to the Chairman of the Publishing Committee, 2065 Adelbert Road, Cleveland, Ohio.

The Chairman of the Publishing Committee should be advised of change of address about fifteen days before the date of issue, with both old and new addresses given.

Because of the second class postal rates in effect the Postoffice does not forward the Bulletin unless extra postage is sent to the Postoffice to which the Bulletin was originally mailed.

Non-Receipt of Copies. — Complaints of non-receipt of copies should be made within ten days following date of publication, otherwise the supply is likely to be exhausted.

The Bulletin of the American Association of Nurse Anesthetists

VOLUME 9, NO. 2 MAY, 1941

THE CONTENTS

PAGE

"Obstetrical Analgesia"
Jerome Pillow Long, A.B., M.D., F.A.C.S., and William P. Maury, B.S., M.D. 73

"The Preparation of the Crippled Child for Surgery"
Fremont A. Chander, M.D. 80

"Vinethene in Dental Surgery"
Bertram S. Rothwell, D.D.S., F.I.C.D., F.I.C.A. 82

"Recent Developments in Carbon Dioxide Absorption"
John Adriani, M.D. 86

"The Responsibility of the Nurse Anesthetist"
Irene M. Mason 91

"Anesthetic Explosion Hazards and Precautions"—Helen Lamb 94

"The Progress of the Nurse Anesthetist"—Miriam G. Shupp 100

"Permanent Values in Organization"—Agatha C. Hodgins 106

DEPARTMENT OF EDUCATION

"Arterial Pressure"—Harold D. Green, M.D. 109

Book Review—"Cyclopropane Anesthesia" by Benjamin Howard Robbins, M.D. — Rosalie C. McDonald 119

Contest 127

Activities of State Associations 130

Notices 144

In Memoriam 153

Advertisements:

Puritan Compressed Gas Corporation ..... Inside front cover
McKesson Appliance Company 69
Dewey and Almy Chemical Company 70
Mallinckrodt Chemical Works 154
The Foregger Company, Inc. 155
E. R. Squibb & Sons 156
The Cheney Chemical Company ..... Inside back cover
The Ohio Chemical & Mfg. Company ..... Outside back cover

OBSTETRICAL ANALGESIA

JEROME PILLOW LONG, A.B., M.D., F.A.C.S.
WILLIAM P. MAURY, B.S., M.D.
Department of Obstetrics, University of Tennessee College of Medicine and Maternity Pavilion, John Gaston Memorial Hospital Memphis, Tennessee

Read at the seventh annual convention of the Mid-South Post Graduate Nurse Anesthetists' Assembly, held in Memphis, Tenn., February 12-13, 1941.

The progress of civilization has always been closely connected with the care which child-bearing women have received. During the primitive period various herbs were administered, both as an aid to delivery, and in an attempt to relieve the agony of labor. Also in this era various charms and symbols were given to women in the belief that they would lessen the pains of childbirth. Very little if any progress was made until the year 1847, when Sir James Simpson of England first used chloroform to relieve the pains of labor for Queen Victoria. Following this, chloroform and ether became very widely used throughout the civilized world, but because of their strong anesthetic qualities, they were used only towards the end of the second stage of labor. In 1902 Steinbuchel first suggested the use of morphine and scopolamine early in labor. Gauss in 1906 reported six hundred labor cases, in which he had used morphine and scopolamine. It was not until approximately 1914, however, that the use of the so-called "twilight sleep" was begun in this country.

Because of the deleterious effect on the child, the use of morphine and scopolamine, although a great advancement, was not entirely satisfactory. Consequently, other means for lessening the pains of labor were sought for, and early in the third decade of the twentieth century Gwathmey's quinine-ether-oil enema was introduced. This was a marked advancement, but still was not entirely satisfactory. Other analgesias were looked for, and the barbitals began to be used. Sodium amytal was the first in this group, and this was rapidly followed by pernoston sodium, and then nembutal.

The ideal analgesia has not as yet been obtained, although there are a large number of drugs, and combinations of drugs, which are now in use. An analgesia, which is ideal during labor, must meet several requirements. It must above all be safe for both the mother and child. It must not weaken the labor pains and lengthen labor, neither must it interfere with the contractile power of the uterus, because of the danger of postpartum hemorrhage. It must be easy and economical to administer, and last, but not least, it should not cause excitement of the patient. With these viewpoints in mind, last year in the John Gaston Memorial Hospital we ran a large series of cases using different drugs and different combinations of drugs, in order that we might compare them, and choose the one which was best fitted. It is quite evident that a set routine should not be used for every patient, but that the attending physician should perfect himself in different methods of analgesia, in order that each case might be individualized.

Barbiturates are mid-brain seda-

tives, and have little effect on the cortical areas. Luminal, veronal and scopolamine act on the cortical centers of the brain, whereas morphine and other opiates affect both. The combination of barbiturates with opiates, scopolamine, or other drugs, which act on the cortical area, have a marked synergistic effect, and are apt to cause respiratory depression in both the mother and child. The toxicity of the barbiturates is inversely proportional to the rate of elimination. The amount of the drug which is destroyed runs parallel to the concentration in the body, and to the initial dose. Half of the initial dose of nembutal is destroyed within thirty minutes when given intravenously. It is much less toxic than sodium amytal, and 30 or 40 grains is within the limits of safety. For hypnosis, 30 to 40 per cent of this dosage is necessary and 60 to 70 per cent for complete amnesia, which is the loss or the lack of memory. Overdosage of barbiturates, or barbiturates combined with opiates or scopolamine, causes respiratory failure. Some patients, being more susceptible, are apt to have respiratory collapse with a smaller dosage than is required for the average individual. The amnesial properties of nembutal and the other barbiturates are greatly increased when scopolamine is used with them, but this combination results frequently in marked excitement. For respiratory failure, caffeine and sodium benzoate, coramine, metrazol, and ephedrine with oxygen and carbon dioxide, are very beneficial. In cases of overexcitement, caffeine and apomorphine, in sub-emetic dosage (grain 1/40 to 1/16) are useful.

In 1939 and 1940 in the John Gaston Memorial Hospital we used various combinations of analgesia, as I have previously stated, in over seven hundred unselected maternity cases. In this paper the authors wish to present the results and conclusions obtained in four hundred cases, in which three different analgesic drugs or combinations of drugs were used. Nembutal alone was used in two hundred cases, nembutal and scopolamine in one hundred, and dilaudid and nembutal in another hundred cases. The series included both white and black patients, primipara, and multipara. The largest para was 10, and we found that in none of our cases the color or para number had any influence on the results obtained. The excitement was less and the analgesia better in patients of the higher mental group, because of their ability to understand what was being attempted.

The dosage of the drug was determined according to the body weight of the patient. Nembutal was found to give better effect when 3 grains were given for women under 100 pounds; 4½ grains from 100 to 120 pounds; 6 grains from 120 to 150 pounds; and 7½ grains from 150 pounds up. A grain and a half were repeated in forty-five minutes, and every hour thereafter as necessary. The smallest effective dose was 1½ grains, and the largest dose used in this series was 15 grains.

In the nembutal and scopolamine series, scopolamine grain 1/130 was used in all cases, and nembutal was given in the same dosage and manner as in the following dilaudid and nembutal group. The smallest effective dose was scoplamine grain 1/130 and 3 grains of nembutal, and the largest dose which was given was two injections of grain 1/130 each and one of grain 1/260 of scopolamine with 9 grains of nembutal; and one of grain 1/130 and two doses of grain 1/260 of scopolamine, combined with 9 grains of nembutal.

With dilaudid and nembutal the in-

itial dosage was dilaudid grain 1/32 for all patients, and the nembutal was varied in accordance with the body weight. We used grains 1½ of nembutal up to 100 pounds; 3 grains from 100 to 120 pounds; 4½ grains 120 to 150 pounds; and 6 grains above 150 pounds. The additional dosage was nembutal grains 1½ as necessary, the same as in the nembutal group, and in a few instances the dilaudid was repeated, grain 1/32 to 1/64. The smallest effective dose was dilaudid grain 1/64 and nembutal grains 3, and the next smallest dose was dilaudid grain 1/32 and 1½ grains of nembutal. The largest dosage given was two doses of dilaudid grain 1/32 each and 9 grains of nembutal, and grain 1/32 and 1/64 of dilaudid, combined with 15 grains of nembutal, with no ill effects to either the mother or baby.

The length of labor apparently was not important in regard to analgesia as in the nembutal group the longest labor was fifty hours and thirty-three minutes; the next longest was forty-eight hours and thirty-seven minutes; and the shortest one hour and twenty minutes. With nembutal and scopolamine one woman was in labor for forty-eight hours, and another for forty hours and fifty minutes, and the shortest time was two hours and twenty minutes; whereas with dilaudid and nembutal, one of our patients had a labor of forty-three hours and fifty-three minutes, another of forty hours and seventeen minutes, and the shortest time in the last series was one hour and fifty-five minutes.

The length of time that the analgesia was given apparently had no ill effects on either the mother or the baby. With nembutal one patient was kept under the analgesia for forty-five hours and twenty-five minutes, and several ran for twenty-four hours. The shortest time after the administration of analgesia was five minutes, but the shortest effective time after the giving of the drug was twenty-five minutes, and the average effective dose required forty minutes to get results. One patient thirty-five minutes after receiving nembutal was delivered, an episiotomy was repaired without anesthesia, and the patient claimed to know nothing of what had happened. With nembutal and scopolamine the longest analgesia was run for twenty-seven hours and fifty-five minutes, and the shortest was seven minutes. The shortest effective time was thirty-five minutes, and the average ran between forty-five and fifty minutes to get the desired effect. One patient, who received dilaudid and nembutal, was kept under analgesia for fifty-five hours, and another for thirty-two hours and fifty minutes, and one was delivered five minutes after the initial dose. None of these showed any ill effects to the mother or child. In this series the shortest effective analgesia which was obtained was one hour in duration.

The time for administering an analgesic was found to depend upon the individual herself, and not upon any specific dilatation of the cervix. As soon as labor is well established the patient may be given an analgesic when the pains begin to bother her. It is important, however, to give it before the patient is too far along, if the desired results are to be obtained. With all three analgesics, we were able to obtain effective results after the cervix was completely dilated. With nembutal, and with dilaudid and nembutal, effective analgesia was obtained when the cervix was only 1½ cm. dilated and about 1 cm. thick. In the nembutal and scopolamine series effective analgesia was obtained when the cervix was only 2 cm. dilated and 1 cm. thick. The average

dilatation of the cervix for good results was approximately 3 cm.

Labor pains were not affected by nembutal in 133 cases, were slightly decreased in 36 cases, and were increased somewhat in 31 instances. Eighty-four patients showed no effect on the labor pains when nembutal and scopolamine were administered, in 14 the pains were slightly decreased (in one of these, contractions stopped completely for twelve hours and evidently the patient was not in true labor at the beginning of the analgesia), and two cases showed a slight increase. Labor pains in 80 cases were not affected by dilaudid and nembutal, in 18 cases the pains were slowed and decreased in intensity, and two showed a slight increase. The dilatation of the cervix played little part in the effect on the labor pains once labor was well established, as in each series the pains were slightly decreased after full dilatation, and each one showed an increase in labor pains when the cervix was only 3 cm. dilated in the nembutal series, and 4 cm. in the other two series.

The blood pressure was practically not affected in any of our series. In 25 cases it was increased, and in 19 decreased with nembutal, the average variation each way being only 4 to 6 mm. of mercury. With nembutal and scopolamine it was increased in 18 patients, and decreased in 7 cases, with a maximum variation of 16 mm. of mercury systolic and 20 mm. diastolic, and the average variation in this series was approximately 10 mm. of mercury. In the dilaudid and nembutal series 11 patients had a slight increase, and 5 a decrease, with an average of 10 mm. of mercury each way.

The pulse rate in all three series of cases also showed a slight change in some instances. Twenty-seven patients showed an increase, and 13 a decrease, which averaged 12 beats per minute with nembutal. Under nembutal and scopolamine analgesia 26 patients showed an increase, 9 a slight decrease in pulse rate, and the maximum variation was 24 beats a minute. In the dilaudid and nembutal group 29 patients showed an increase and 3 a decrease, the largest increase being 28 beats a minute, and the average for both of the latter series being about 10 beats.

Supplementary anesthesia was used for the delivery in some instances in each series, and regardless of the type which was used, we found that less anesthesia was required, and that the patients were affected more quickly than those who had received no analgesia. Different types of anesthesia were used. With nembutal 107 primipara received general anesthesia, one local anesthesia, and 35 were delivered without anesthesia. There were 7 multipara who received an additional anesthetic, and 50 were delivered without any. Open drop ether was used in one case, nitrous oxide in 97, and nitrous oxide and ether in 16. In the nembutal and scopolamine group 57 primipara received additional anesthesia for delivery, and 17 were delivered under the analgesia alone. Twelve multipara were given a general anesthetic, and there were 14 who received none. Nitrous oxide was used in 43 cases, and nitrous oxide and ether in 26. In the third group in which dilaudid and nembutal was used, 53 primipara and 14 multipara were given a general anesthetic toward the end of the second stage, and 4 primipara and 29 multipara were delivered under the analgesia only. Two patients received open drop ether, 59 nitrous oxide, 4 nitrous oxide and ether, and for 2 patients novocaine was used as a local anesthesia for the delivery and the episiotomy.

There were no maternal deaths in

this entire four hundred cases. There were, however, twelve fetal deaths. Six of these babies were macerated at the time of delivery; the fetal heart in 3 cases was not heard before the analgesia was begun. The one fetal death in the nembutal series occurred after a prolonged labor of thirty-six hours and thirty minutes and a difficult delivery by internal podalic version. This patient was under analgesia twenty-four hours, and was delivered under nitrous oxide and ether anesthesia. The fetal heart was good until the delivery was begun, but there was no heart beat after the completion of the operation. All three babies which were stillborn in the nembutal and scopolamine group were macerated. There were eight deaths in the dilaudid and nembutal series. Three of the above macerated fetuses were found in this group. In one death the fetal heart was not heard on admission. Of the remaining four deaths, one was a six and one-half months premature infant, who breathed but did not cry and expired shortly following delivery. One was a stillborn infant, whose fetal heart was not heard before the beginning of the analgesia. In the third instance of fetal death, the patient was in labor for nineteen hours and twenty-five minutes, and received during this time only dilaudid grain 1/32 and 4½ grains of nembutal. She was delivered under nitrous oxide and ether, and although the fetal heart was beating following the delivery, the baby was never resuscitated. The fourth death occurred following a short labor of three hours and fifty-five minutes, during which the patient was under analgesia of grain 1/32 of dilaudid and 3 grains of nembutal for a period of one hour and fifty minutes. This infant weighed only 2 pounds and 7 ounces, and gasped several times but was never made to cry. Of all the fetal deaths only two (and one of these was a premature child) could in any way be blamed on the analgesia. Of two hundred mothers receiving nembutal only three had babies who failed to breathe spontaneously.

The shortest time for narcotization between the administration of the drug and the delivery was one hour and ten minutes, and the longest time was three hours. One of these three was a seven and one-half months premature baby. Thirty-three children in the nembutal and scopolamine group were narcotized in varying degrees, and required some form of resuscitation, which varied from gentle spanking to the administration of stimulants and carbon dioxide and oxygen. The shortest time for narcotization after the administration of the drug was fifty-three minutes, and the longest was eighteen hours and fifty-seven minutes after the beginning of the analgesia. Thirty-three newborn were narcotized in the dilaudid and nembutal series and all were revived. The shortest time for narcotization after the beginning of the analgesia was forty-four minutes, and the longest time was thirteen hours.

The results of the analgesia have been subdivided into objective and subjective. In the objective type the authors used "poor" for patients who apparently were wide awake; "wild" for patients who were extremely restless; "fair" when the patient slept between the pains and was aroused by them; and "excellent" where the patient slept both between and during contractions. The subjective results were calculated as to the patient's remembrance of labor. Those who were called "poor" remembered practically the entire procedure; "fair" where the patient remembered parts of labor or delivery; and "excellent" when she could recall nothing that had happened. The subjective results of the

women who did not receive any supplementary anesthesia for the actual delivery have also been graded as under the other subjective group.

Of the two hundred patients who received nembutal, the objective results were classified as follows: 24 were "poor" and of these 17 received the drug between ten and forty minutes before delivery, which was too soon for it to take effect, and one patient was in labor for ten hours, and received only 4½ grains of nembutal; 4 were classified as "wild," and mild restraint was necessary; 62 patients were "fair"; and 110 were "excellent." Subjectively, 37 patients in this series were "poor"; 33 "fair"; and 130 were "excellent." Without anesthesia there were 21 "poor," 2 of whom vomited the medication; 14 "fair"; and 50 "excellent." One of the latter was delivered without any anesthesia, but repair was done under nitrous oxide and the patient claimed to remember nothing that happened.

In the nembutal and scopolamine group the objective grading was as follows: 10 "poor," 8 of these receiving the medicine between ten and thirty-five minutes before delivery; 58 were "wild" and had to be restrained; 7 were "fair"; and 25 were "excellent." Subjectively, there were 8 "poor"; 15 "fair"; and 77 "excellent." Without anesthesia in this series 4 cases were "poor"; 5 "fair"; and 22 "excellent."

In the third series in which dilaudid and nembutal were used, the objective results were 17 "poor," one of whom received the drug too close to delivery for any desired results; none of these patients were "wild"; 30 were "fair"; and 53 "excellent." Subjectively 20 were "poor"; 34 "fair"; and 46 "excellent." Of those delivered without any anesthesia in this group, 8 were considered "poor"; 12 "fair"; and 13 as "excellent." The results subjectively were considered to be satisfactory both in the fair and excellent groups. Consequently, we had satisfactory analgesia in 81½ per cent of the cases under nembutal, 92 per cent under nembutal and scopolamine, and 80 per cent with dilaudid and nembutal.

Summary:

Of four hundred unselected maternity cases at the John Gaston Hospital, two hundred received nembutal, one hundred nembutal and scopolamine, and one hundred dilaudid and nembutal. The dose was given according to the body weight, and all three analgesias were given over a large variation of time. The average time for nembutal to be effective was found to be forty minutes, forty-five to fifty minutes for nembutal and scopolamine, and one hour for dilaudid and nembutal. Labor pains in all three series were very little affected, and the same was true of the blood pressure and the pulse rate. One hundred and fourteen patients in the nembutal group received supplementary anesthesia, 69 in the nembutal and scopolamine group, and 67 in the dilaudid and nembutal series. Only three babies out of two hundred were narcotized after the mother received nembutal, whereas 33 babies in the other two series required resuscitation. Only two fetal deaths could in any way be blamed on the analgesia, and in both of these instances the mother received dilaudid and nembutal. None of the women was wild after receiving dilaudid and nembutal, and only 2 per cent of the nembutal group required restraint. When nembutal and scopolamine were given 58 patients had to be restrained. The subjective results in all three series were good, but were better in the nembutal and scopolamine group, which had a satisfactory result in 92

per cent of the cases as compared to 80 per cent for dilaudid and nembutal, and 81½ per cent for nembutal alone.

Conclusions:

1. Analgesia should be given to women in labor, but no set routine should be used in all cases; instead, each patient should be individualized.
2. Nembutal and scopolamine gives a more effective analgesia than nembutal, or nembutal and dilaudid, but causes more excitement of the mother, and more "sleepy" babies than does nembutal alone.
3. Nembutal when used alone for analgesic purposes is safer for the baby than either nembutal and scopolamine, or nembutal and dilaudid, and the patient is easier to control when under it.
4. Nembutal when combined with opiates, such as dilaudid, gives no better analgesia than does nembutal alone, and it is more apt to necessitate resuscitation of the newborn.
5. Supplementary anesthesia should be used for delivery and repair of parturient women, and less of it is required when analgesia has been used during labor.

The authors wish to express their appreciation to the house and nursing staffs of the Maternity Pavilion of The John Gaston Memorial Hospital, for the very valuable aid which they gave in coöperating in the study of these cases.

BIBLIOGRAPHY

1. Abbott, W. F.: Canadian Med. Assoc. Jour., 27; 620, 1932
2. Averett, L.: Am. Jour. Obs. and Gyn., 27; 109, 1934
3. Boylan, J. P.: Am. Jour. Obs. and Gyn., 29; 440, 1935
4. Conn, L. C., and Vant, J. R.: Canadian Med. Assoc. Jour., 33; 484, 1935
5. Conn, L. C., and Vant, J. R.: Canadian Med. Asso. Jour., 35; 281, 1936
6. Danforth, D. N., and Danforth, W. C.: Western Jour. of Obs. and Gyn., Vol. 46, 1938
7. Galloway, C. E., and Smith, P. H.: Am. Jour. Obs. and Gyn., 29; No. 2, 207, 1935
8. Hunt, C. E.: Northwest Medicine; 34, No. 6, 191, 1935
9. Irving, F. C., and Berman, S., and Nelson, H. B.: SGNO; 58, 1, 1934
10. Kohn, R.; Richards and Grimes, C.: Anaesthesia and Analgesia; No. 18, 1939
11. Long, J. P.: Jour. Tenn. State Med. Asso. Jour., 29; 4, 135, 1936
12. Lundgren, A. T., and Boice, A. W.: SGNO, 70: 120, 1940
13. Mallinson, F. B.: British Jour. of Anaesthesia; Vol. 15: No. 3; 104, 1938
14. Maygill, I. W.: Lancet: Page 74, Jan. 31
15. Rosenfield, H. H., and Davidoff, R. B.: SGNO; 60, 235, 1935
16. Ruch, W. L.: Am. Jour. Obs. and Gyn., 35: No. 5, 830, 1938

THE PREPARATION OF THE CRIPPLED CHILD FOR SURGERY

FREMONT A. CHANDLER, M.D.

Children's Memorial Hospital, Chicago, Illinois

Read at the seventh annual convention of the Mid-South Post Graduate Nurse Anesthetists' Assembly, held in Memphis, Tenn., February 12-13, 1941.

Modern surgery is always a scientific adventure in which a group of collaborators attempt to carry some unfortunate patient through a hazardous ordeal in the effort to better his or her physical well-being. The charted course may seem clear and the sailing free. Too often, however, our navigation charts are inadequate, soundings are not correct, reefs are unknown or are variable, beacons and buoys fail to function. To bring a patient to a safe port may be the simplest thing imaginable but, on the other hand, the course may be stormy, the ceilings low and the location of the port obscure. In other words, the successful culmination of such a scientific venture, i. e., a surgical operation, calls for team work from a trained crew cooperating at every stage of the voyage. The surgeon, acting as skipper, cannot sail without the help of his mates — the anesthetist, the surgical assistants, the nursing staff and a large unseen crew of other hospital personnel. The more stormy the voyage, the more thorough the team work necessary. All should be experts accustomed to working together.

In too many instances the peculiar lot of the anesthetist in the hospital organization is not conducive to her remaining as an integral part of the team over long periods of time. The long hours on duty and "on call", the necessity of living in the institution, the peculiar tolerance that is so frequently extended to her by the hospital administration, and the material compensation that is frequently not commensurate with the responsibility she assumes in performing her assignment, contribute to this. Instead of commiserating with the anesthetist on the things that are not right, I would like to direct your thoughts to an ever-enlarging field of usefulness.

The anesthetist should be invited to attend the rounds or consultations at which operative procedures are decided upon. She should

1. Observe the patient prior to his appearance in the operating room.
2. Be familiar with his preoperative condition, laboratory findings, and medication.
3. Know the extent and hazards of the proposed operation.
4. Have direction of all phases of the anesthesia.
5. Be prepared to direct or to administer emergency measures in the operating room and if necessary in the room or ward upon the patient's return.
6. Be equipped to administer oxygen, carbon dioxide, et cetera, in operative and non-operative cases.

In other words, the anesthetist should become a specialist not only in the administration of anesthetic drugs, but also in preparing the patient for operation and in administering supportive measures following surgery. Such a conception of the rôle of the anesthetist may seem fan-

tastic. The scope of her authority would have to be adjusted. Such an expansion of her duties would meet with enthusiastic endorsement by most surgeons, and in the end, the lot of the anesthetist would be greatly improved.

Returning from this brief ethereal flight, I wish to outline the plan that we follow in caring for children on the orthopedic service at the Children's Memorial Hospital, Chicago,—a general children's hospital which operates a large dispensary. The hospital has a capacity of about 260 beds, of which 40 to 45 are orthopedic. Outpatients are seen by the orthopedic staff at rather short intervals. All patients are weighed routinely. Routine Kahn and Wassermann tests are done. If operation is indicated, the Chief of the Service reviews the case and certifies the admission recommendations. The patient is examined carefully from a medical, dental, nose and throat angle and given all adequate care that is indicated to remove foci of infection. This assures the patient being in the best condition possible.

All patients excepting those requiring emergency operations are admitted on Friday morning. They are again checked medically and from a dental standpoint. Admission is refused if any condition which would contraindicate surgery is present. Laboratory studies, x-rays, et cetera, are brought up to date during the afternoon. On Saturday morning all admissions are reviewed by the orthopedic staff and by representatives of the medical staff. All patients are placed on a general diet, and on Sunday morning (two days preceding surgery) are given orange juice and lactose in unrestricted amounts. Forty-eight hours of surgical preparation is instituted, and all patients are placed on fracture beds.

At midnight Monday, all food and fluids by mouth are stopped and rectal fluid (1 per cent glucose in water) is started, using a tidal flow method. Such fluid makes water available and eliminates dehydration. This operates till 4 a. m. Any fluid that remains in the rectum is syphoned off at 6 a. m.

The patient goes to surgery Tuesday morning, and is given the anesthetic of choice, usually open drop ether, or occasionally ethylene. The surgery is done as gently and rapidly as is consistent with good work. The anesthesia is light and the patient, as a rule, is coming out of it as the operation is completed. On the return of the patient to bed in the ward, rectal fluids are immediately started and continued until fluids are taken freely by mouth. A general diet is started as soon as it can be tolerated.

This routine probably differs from that used in most hospitals only in the emphasis placed on rectal fluids. By the use of a tidal flow technique, overfilling of the colon is avoided. If the colon contracts, the fluid returns to the container and re-enters the body when the spasm has subsided. Amounts varying from a few hundred cc. to as much as 6000 cc. have been absorbed during the immediate postoperative course. This would certainly indicate that a pronounced dehydration had been produced by perspiration, loss of blood and respiratory loss in the operating room. Since the establishment of the use of this rectal fluid technique, our postoperative reactions and emergency transfusions have been reduced to a minimum.

In closing, may I stress the fact that the morbidity and mortality of elective surgery in children should be nil. Instead of relying on corrective measures used only after unfavorable

reactions have occurred, good surgery can be accomplished only with sound surgical judgment and technique, a safe anesthetic, operating room teamwork and the employment of preliminary supportive measures.

VINETHENE IN DENTAL SURGERY

BERTRAM S. ROTHWELL, D.D.S., F.I.C.D., F.I.C.A.
946 Rose Building, Cleveland, Ohio

The dental surgeon should cooperate with the anesthetist, and vice versa. The surgeon should see that the patient is placed in the proper anesthetic position in the dental chair, so that when the mouth is open, the lower jaw will be parallel with the floor or the arm of the chair. This eliminates the downward pressure on the hyoid bone, which, if the jaw is allowed to be pushed downward during operation, will close off the breathing. Furthermore, if the head has been placed backward, too far over the headrest, it has a tendency to stretch the neck, which makes breathing difficult and gives the patient a strangling sensation. The anesthetist should be trained to hold the head and lower jaw in position during anesthesia and the operating stages, with the aid of the dental surgeon. The best results in inhalation anesthesia are brought out by a thoroughly competent anesthetist ably supported by a well trained, coöperative operator.

The most important thing about any anesthesia is an open, unobstructed airway to permit the free flow of the anesthetic to the lungs. An essential for inhalation anesthesia, when the mouth is open, is proper obstruction of the inspiration of air through the mouth, which always dilutes the proper mixtures that the anesthetists have obtained and precludes anesthesia.

The technique is a matter which among other considerations concerns the temperament, habits and health of each patient, and is not a fixed mechanical routine. It is rather meeting exigencies as they arise and using an apparatus capable of measuring up to the demands placed upon it. No man can administer an anesthetic and operate at the same time and expect good results. He may have a certain degree of success for a while in uncomplicated cases but sooner or later trouble ensues with the difficult cases, and nitrous oxide shoulders the blame.

While obstruction of inspiration through the mouth may be accomplished by an excessive flow of gas under pressure, administered through the nose, the obstruction of choice (for oral surgery) is an oral pack, so placed that it does not encroach upon the oropharynx and thus leaves the naso-pharyngeal airway open. The pack should so fill the back part of the mouth from the soft palate to the base of the tongue, as to effectively block inspiration through the mouth. The pack may be gauze or cotton, or better still, a combination of cotton and gauze. It must be large enough to fill the space it is to obstruct, therefore its size will vary for adult males, for adult females and for children.

Since an unconscious patient may bite viciously, a mouth prop must be placed between the teeth. Next to this, the placing of the pack is of utmost importance. It must be introduced during expiration, while the

tongue is held forward and pushed downward by the index finger. It is to be emphasized that the placing of the mouth prop, as well as the introduction of the pack, must be accomplished during a single expiration, and it must be completed before the patient can breathe in any air; for during induction even one inspiration of air may seriously impair the anesthesia by diluting the concentration of the anesthetic in the lungs. A properly placed pack will help to hold the tongue and the faucial soft tissues out of the pharynx, and thus while it blocks the mouth, it will prevent blocking of the pharynx. An improperly placed pack may be pushed into the pharynx, obstructing the airway, or it may fail to obstruct respiration through the mouth, or it may encroach upon the operative field. When the technique of the pack is carried out properly, the bugbear of dental anesthesia is removed, and it becomes as simple as anesthesia for any other kind of surgery. The necessity for administering gases under pressure no longer exists, and as a matter of fact, a volatile agent may be used with efficiency by the open method of administration.

Many dental operations and most out-patient clinic operations are ultra-short and require only a few minutes of general anesthesia; usually they may be performed in the lightest plane of anesthesia, since relief of pain and quick recovery is more important than relaxation. Although muscle spasm, particularly "freezing of the masseter muscle" (frequently characteristic of ethyl chloride anesthesia) may not be tolerated, it is not necessary, indeed it is undesirable, to produce profound relaxation of the skeletal muscle. Much more desirable is quick and complete recovery of the patient after the operation is completed. However, these operations do cause great pain, therefore total analgesia, not merely light analgesia, is required.

Sydney Lyons described a technique for administering vinethene which was simple, safe, and sure of producing that "total analgesia" which Guedel says: "affords the surgeon as much ease and comfort in operating as the state of deepest third stage anesthesia." With those slight variations which suit the individual needs in our clinic, we have used this technique for administering vinethene by the open drop method, and have discovered that the stage of tranquillity can be reached and maintained with a maximum of comfort as well as of safety to the patient.

Let me describe briefly the dental extraction department of St. Vincent's Charity Hospital in Cleveland, where nearly seventy thousand patients have been safely anesthetized for dental operations in the past fifteen years. There are two dental rooms, with one dental operating chair in each room, and in a separate recovery room there are three backless chairs alongside a trough-like cuspidor. Quick and complete recovery of the patient after the operation is not only desirable, but it is imperative, for in an average clinic morning there are from thirty-five to forty-five patients to anesthetize. In order to maintain this rate, the individual patient must not occupy a recovery chair for longer than eight to ten minutes. Almost never does a bottleneck congestion in the recovery room delay the schedule.

When any inhalation anesthetic is administered, the stomach should be empty, but if the patient has eaten and the operation cannot be delayed, vinethene is the anesthetic of choice. We prefer to operate on the patient in the sitting position and rarely is it necessary to use restraining straps, since there are always several

of the staff present if a patient should require restraint. In a private office where there is leisure but not assistants, restraining straps should be snugly fastened before any anesthetic is started.

Mrs. Gertrude Fife, Chief of the Anesthesia Department of the University Hospitals of Cleveland, has devised a small nasal mask from a muslin-covered tea strainer, which is preferable for the administration of vinethene by the open drop method, when operating on children for removal of infected teeth or for opening abscesses. This technique is especially convenient for anesthetizing bedridden patients. Induction is just as rapid as with an anesthetic gas and much more certain than with nitrous oxide-oxygen alone. In twenty to forty seconds after the first inhalation of vinethene, the patient is unconscious, and even the most resistant usually sink into unconsciousness without any struggle.

We explain to the patient that he is to be anesthetized by an inhalation anesthesia which we will drop onto the four to six layers of gauze which we hold. The tip of the metal dropping cap is adjusted to permit fifty to seventy-five drops per minute when the bottle is held upside down and we put a few drops on the gauze before it is placed in front of the nostrils and mouth. After a few breaths, the patient becomes accustomed to the vapor, and the mask is then fitted slowly over the nose. The odor is not obnoxious to the patient, if vinethene is not administered too rapidly. While the first drops are falling on the mask, the patient is told that he will feel dizzy within a few breaths. We then fit the mask more snugly about the nose and a piece of gauze with a few drops of vinethene on it is placed over the mouth, and the dose increased to the full rate of seventy-five drops per minute. We reassure the patient constantly and explain to him that when he feels dizzy he must tell us, so that then we will ask him to open his mouth.

Usually the patients cooperate beautifully and volunteer—"I am dizzy." We ask, "Are you sure?" They respond at a slightly higher pitch—"Yes, I am sure." Then the command—"Open your mouth" brings prompt obedience. As the jaw drops, the mouth prop is placed in the required position. On exhalation, we place a gauze pack with a few drops of vinethene on it, in the vault of the mouth in such a manner that the patient is forced to breathe through the nose and vinethene is continued without interruption upon the mask, which has been fitted snugly over the nose. The patient is ready for operation: Teeth may be removed, or any other short surgical operation may be performed.

Vinethene must be administered until the operation is completed. The mask is then removed and the gauze pack is brought forward to the anterior teeth, replacing the prop. The patient is gently, but firmly commanded, to close his mouth. In fifteen to thirty seconds, after discontinuing the vinethene, the patient responds, and having regained consciousness, orients himself quickly. Since the anesthesia is very light and quite short, and since vinethene is very volatile, complete recovery is immediate. It is quite unlikely that an over-dose of vinethene will be administered while using this method. However, should the respirations become shallow, irregular, jerky, or should the pupils dilate, then remove the mask, remove the oral pack, make sure of an open and clear airway and if necessary resuscitate the patient, using artificial respiration.

When vinethene is administered by machine, only a small quantity is required. We have induced thirty an-

esthesias using only 25 cc. of vinethene. Routinely, we set the dials so as to deliver a flow of gas which is 20 per cent oxygen and 80 per cent nitrous oxide, and then the vinethene vaporizer is opened gradually, allowing a breath or two before each increase of vinethene. We make about six steps before the vaporizer is as much as half open. A few adults may require more vinethene, but we seldom open the vaporizer more than three-fourths and never bubble the gas through vinethene in those vaporizers which permit bubbling. Rarely do we increase the nitrous oxide to more than 80 per cent, although in exceptionally resistant patients, for a period of not more than thirty seconds, we may increase the nitrous oxide to 85 per cent. Under such necessity, we may administer a greater concentration of vinethene for a short time, but we quickly resume the less concentrated anesthetic mixture and raise the oxgen to 20 per cent for maintenance. When the operation is completed, we turn off the vinethene and empty the rebreathing bag, and after a few breaths the oxygen is turned off and the nose piece removed. This method of administering the anesthetic has been so well tolerated by all of our patients and eliminates so satisfactorily the hazards of nitrous oxide-oxygen alone, that we are using it extensively in all types of dental operations.

We also use a machine which has the eight-drop method of adding vinethene to the gases. Here, too, we routinely start with 20 per cent oxygen and 80 per cent nitrous oxide. We then start the vinethene dropping at the rate of about fifty to sixty drops per minute. The figures which we have given are those of the machine settings which are routinely used at the start of an anesthesia. Each patient is an individual and an individual dose of the anesthetic is required. The dosage is carried to suit the need of the moment. We try to fit the anesthesia to the patient and with a sufficient amount of vinethene added to nitrous oxide and oxygen, we have been able to control our patients while still maintaining an oxygen concentration which prevents asphyxia.

The induction of anesthesia is rapid. There is seldom any excitement. The respirations become only slightly more frequent and slightly more shallow than normal, but remain quiet, smooth and rhythmic during light and moderate anesthesia. Only when an over-dose is given does the respiration become irregular. In our experience, the respiration is the most important sign of the depth of the anesthesia, as in the administration of any anesthetic. The pulse does not perceptibly change in light anesthesia. In deep anesthesia, the changes in the blood pressure and in the pulse rate are quite similar to those seen in comparably deep ether anesthesia. Cyanosis is never present, though a plethoric sort of flush may be observed occasionally. Lachrymation is noted frequently. We have not observed an excess of saliva except in a few cases where we were aware that vinethene had been administered too rapidly.

Because it is very volatile, vinethene must be kept tightly stoppered. It should be stored in brown glass bottles, in a cool, dark place. It is inflammable and explosive within the same limits as ether and therefore it should never be used near an open flame, or with a cautery. If the container has been opened and promptly and tightly closed again, the remaining vinethene may be used during the next few days. If it has been exposed to gaseous mixtures containing oxygen, however, it should be discarded at the end of the next day. We find

the 25 cc. size bottle to be most convenient for open drop use in our clinic.

SUMMARY:

After anesthetizing over 67,853 patients without a death, we are convinced that whether or not asphyxia is the root of all anesthetic evil, it should be avoided. A technique for administering satisfactory dental anesthesia with 20 per cent oxygen is described. An efficient method of blocking the open mouth facilitates the use of inhalation anesthesia in dental surgery. A technique for placing a throat pack is described.

RECENT DEVELOPMENTS IN CARBON DIOXIDE ABSORPTION

JOHN ADRIANI, M.D.
Director of Anesthesia,
Charity Hospital of Louisiana at New Orleans

Read at the annual meeting of the Southeastern Assembly of Nurse Anesthetists, held in New Orleans, Louisiana, April 17-18, 1941.

Rebreathing with the carbon dioxide absorption method has resulted in improvements in at least three phases of inhalation anesthesia. Firstly, the physiological aspects are controlled more readily. Secondly, it allows a saving of anesthetic drugs never realized before. Thirdly, the completely closed system has reduced the hazard of explosions by confining inflammable mixtures. Although the carbon dioxide absorption technique was introduced in anesthesia in 1923, it was not until recent years that its use became widespread. This was probably due to the influence of cyclopropane. The expense as well as the inflammability of the gas would have made its use prohibitive by the open methods. The improvements in the quality of the absorbents have likewise contributed to the advancement of these techniques.

At present alkalis are the best absorbents for carbon dioxide. From the standpoint of convenience in handling, efficiency, and cheapness soda lime is the most popular absorbent. Soda lime is a mixture of calcium and sodium hydroxides. That used for anesthesia is a special mixture containing 5 per cent sodium hydroxide and a high grade form of calcium hydroxide. To this is added a small percentage of silica, which gives the mass hardness and maintains its shape so that dust formation is prevented. Two types of lime are on the market: the moist, which has added to it 14 to 20 per cent water, and the dry, which contains less than 2 per cent. The moist lime was designed primarily for acidic substances of low activity, such as carbonic acid. Both types have been used experimentally in canisters, and found to be satisfactory. It must be remembered that one-fifth by weight of the moist lime is water. Its absorption power per pound is less, and it may be more economical to purchase the dry.

The sodium hydroxide confers activity, as it is a stronger alkali and more soluble than the calcium hydroxide. If more than 5 per cent is used in the mixture there is a tendency to excessive heating, caking, and deliquescence. If less than 5 per

cent is used the activity and efficiency decreases. The reaction of absorption is a neutralization. Carbon dioxide combines with water to form carbonic acid, which yields hydrogen ion. This combines with the hydroxyl ion from the alkali to form water. For each gram molecule of carbon dioxide absorbed 18 grams of water are formed, and 14,000 calories of heat are liberated. Heat and water formation are evidence of absorption.[1]

The soda lime is prepared in irregular shaped granules of certain graded sizes. The size is important. If they are too large, resistance is minimized, but absorption is less efficient because the number of granules per cubic centimeter of space is insufficient to expose an adequate surface per unit weight of lime. If the size of granules is decreased, efficiency of absorption is increased, but resistance is increased also. An intermediate mixture of 4 to 8 mesh lime has been found to be most effective and satisfactory.

Two types of units are known. The more familiar or "circle" filter consists of a canister with valves interposed at the outlets which allow only an indirectional flow of gases over the absorbent. The gases come into contact with the lime once only. The other and less popular type of unit is the "to and fro," in which gases pass from the mask into the canister and bag on expiration and back over the lime on inspiration. On a mechanical respirator producing normal conditions of respiration it was found possible to compare these two types of units, in the laboratory.[2]

With a tidal volume of 500 cc., a carbon dioxide output of 150 cc. per minute, and a respiratory rate of 20 on an 8 x 13 centimeters canister charged with one pound of 4 to 8 mesh soda lime, carbon dioxide absorption proceeded efficiently for two and one-half hours with a unidirectional flow as is found in the "circle" filter. Under identical conditions the "to and fro" method absorbs efficiently for five hours. This does not mean, however, that after two and one-half hours the charge of soda lime in the "circle" filter is no longer efficient. If either unit after exhaustion is allowed to rest a half hour or more and used again, absorption will proceed once more as efficiently as before. This rejuvenation is explained by the fact that sodium hydroxide, which is more active, combines preferentially with the carbon dioxide to form sodium carbonate.

This sodium carbonate reacts with the calcium hydroxide, which is less soluble and less active, to form calcium carbonate, and regenerates sodium hydroxide once more. Calcium carbonate is insoluble and of course this reaction is non-reversible. Under these conditions the "circle" filter will absorb for a two-hour period before another apparent exhaustion. After several periods of use with intervening rest, each one of which is shorter than the preceding one, the charge is really exhausted. The period of use after rejuvenation is much less for the "to and fro," lasting another hour, and then the charge is completely exhausted.

Weight for weight then, approximately the same number of hours are obtained per pound of lime in each type of unit. The maximum efficiency obtained from the unit and the absorbent is therefore dependent upon an understanding of these physical and chemical principles. A two chambered absorber is ideal in a "circle" filter, as one chamber can rest and reactivate the lime while the other is in use. The apparent better efficiency with the "to and fro" method is due to surface reactions on the granules. As air sweeps into the canister on expiration, one side of the granule is exposed; as it returns to

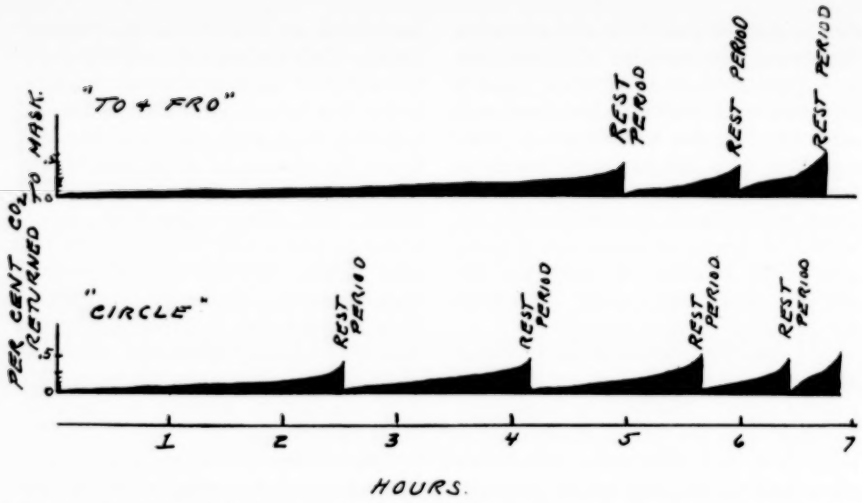


FIG. I. A comparison of the "circle" and "to and fro" systems is shown under identical conditions. A return of activity occurs after an apparent exhaustion with a rest period in each type. The "to and fro" absorbs continuously over a longer period of time, but with adequate rest periods the total number of hours per pound soda lime is the same in both types. Both types absorb effectively during their periods of efficiency.

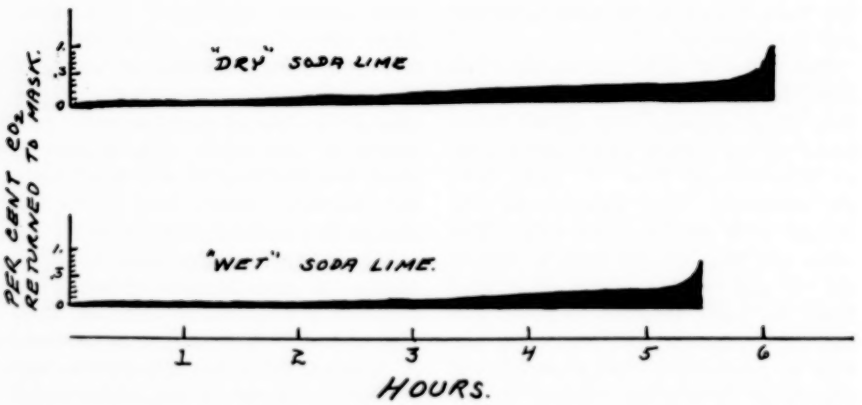


FIG. II. A comparison of "moist" and "dry" limes is shown under identical conditions. There is little variation in efficiency of either type.

---

the mask on inspiration the other surface is exposed. In the circle filter only one surface is exposed. The rest periods allow the sodium carbonate to permeate through the entire granule and eventually convert all the calcium hydroxide to carbonate.

The size of the canister is an important feature also. In an 8 x 13 centimeter canister charged with 500 grams of lime, the air in between

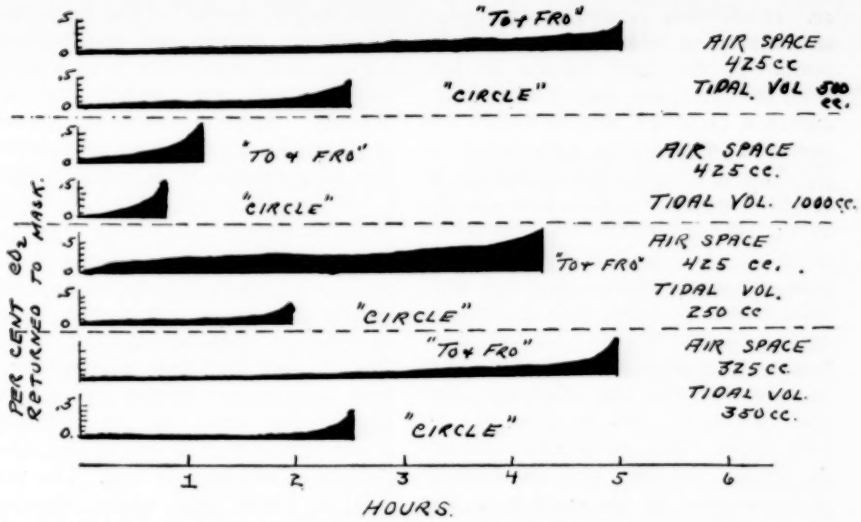


FIG. III. The relationship of tidal volume to air space in the canister, compared under identical conditions, is shown. When the tidal volume exceeds the air space the efficiency is decreased. When it is less in the "circle" filter the efficiency changes little, but in the "to and fro" the efficiency falls. A smaller canister, accommodating the tidal volume, would be more efficient in this type.

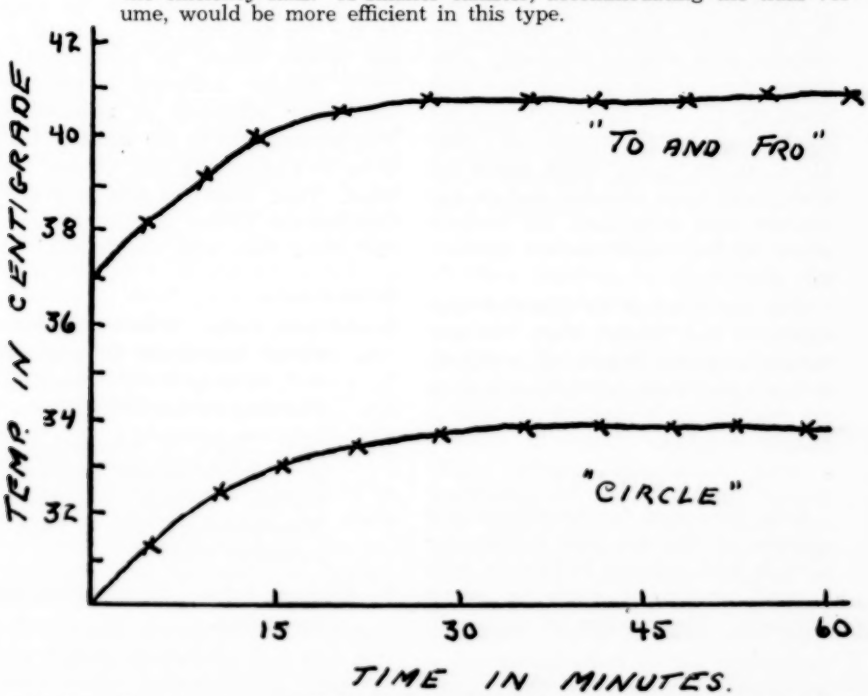


FIG. IV. The temperature of the gases in the mask. "To and fro" and "circle" filters are compared under similar conditions. The "circle" filter dissipates heat more readily.

and in the granules amounts to 425 cc. If the tidal volume approximates this air space the efficiency is optimum. If the tidal volume is less than the air space, such as might occur in a child or in respiratory depression, efficiency is unimpaired in the "circle" filter, but decreased in the "to and fro." The lime in the front portion of the canister is exhausted, while that in the rear portion remains unused. A small canister should be used, such as 7 x 12, or 6 x 10 centimeters. If the tidal volume is greater than the air space of the canister the efficiency likewise decreased, but in this case in both types. The gases rush through so quickly, as they are not entirely accommodated by the container. The shape of the canister affects efficiency little, provided the air space and tidal volume relationship are maintained.[3]

The heat factor becomes a problem in the "to and fro" unit because the canister is so close to the mask. The temperature of the reacting lime may reach 60° C. The temperature in the mask may vary between 39° and 41° C. In the "circle" filter, where the tubing and large chamber radiate and conduct heat with ease, the temperature in the mask rarely exceeds 32° C.

The dust factor is likewise negligible in the "circle" filter. It may become a potent source of irritation to the upper respiratory passages in the "to and fro" filter if the lime is fragile or dusty.

SUMMARY

Soda lime used for anesthesia is a mixture of five per cent sodium hydroxide with calcium hydroxide, with a small amount of silica to impart hardness. The reaction of carbon dioxide absorption is one of neutralization, which results in the formation of water, calcium and sodium carbonates and heat. The 4 to 8 mesh size is best for present-day appliances. After a continuous period of use there is an apparent exhaustion of a charge in a canister, with a revision of activity after thirty or more minutes.

The "circle" filter absorbs for a number of short periods of approximately one and a half to two hours each before total exhaustion occurs. The "to and fro" type absorbs for a long continuous period up to five hours, after which the life following a rest period may be one or two short periods of one hour or less. The sum total of hours used under identical conditions per pound of lime is the same for each type of unit. The optimum absorption occurs when the air space in the canister and the tidal volume of the patient are the same. In the "to and fro" filter a small tidal volume should be accommodated by a smaller canister; in the "circle" filter efficiency is unimpaired. The temperature in the mask is from 6° to 9° higher with the "to and fro" filter. Dust from the lime is a more troublesome factor in the "to and fro" filter than with the "circle."

Bibliography

1—Adriani, John. "The Pharmacology of Anesthetic Drugs," second edition, 1941, Charles C. Thomas, Springfield, Illinois.

2—Adriani, John, & Rovenstine, E. A. "Experimental Studies on Carbon Dioxide Absorbers," Anesthesiology, Vol. 2, Page 1, January, 1941.

3—Adriani, John. Unpublished Observations.

THE RESPONSIBILITY OF THE NURSE ANESTHETIST

IRENE M. MASON
Greenville, Mississippi

Read at the seventh annual convention of the Mid-South Post Graduate Nurse Anesthetists' Assembly, held in Memphis, Tenn., February 12-13, 1941.

I believe that the responsibility of the nurse anesthetist is three-fold but that each of the three aspects is so closely related to the others that it is not possible to differentiate entirely one from the other. I shall try to separate them, however, and discuss them in what I consider the order of their importance.

First there is the responsibility of the nurse anesthetist to the patient. The anesthetist should recognize that her primary obligation is efficient service to the patient. She knows that his recovery is, to a great degree, dependent upon the manner in which she administers the anesthetic. The personality of the anesthetist has much to do with her success in controlling the patient, both before and during the progress of the anesthesia. A gentle, kindly manner and confident attitude will do much to calm the fears of an apprehensive patient and add assurance and satisfaction to his state of mind. Any anesthetist knows that a patient who is frightened and nervous before taking an anesthetic presents a much graver problem of anesthesia and is more susceptible to shock, than one whose mind is perfectly satisfied that he will drop off to sleep easily and comfortably, and experience a pleasant awakening. An understanding sympathy combined with an explanation of what is to be done, will almost always call forth intelligent coöperation from the patient, with the resultant satisfactory anesthesia.

The nurse anesthetist is employed in a highly specialized field and carries a major responsibility. Her duties during an operation are to control the patient's pain, safeguard his well-being and maintain the proper amount of relaxation during the different stages of the operation. By so doing she provides as nearly as possible the optimal conditions for the recovery of the patient. In order to achieve the best possible management of each anesthesia she must have an understanding of human physiology, especially with reference to the respiratory, cardiovascular and nervous systems. She must have a conception of how these functions are altered by disease, since patients requiring surgery are not normal, healthy people. She should know what physical changes are created by the induction of potent gases into the system, and what reactions she may expect with each condition.

Since each patient presents an individual problem in anesthesia, the anesthetist should make a serious study of each case as it is presented to her. She should become familiar with the essential points in the history and condition of the patient, especially in regard to the cardiovascular system. She should have a knowledge of the laboratory reports and should know exactly what preoperative medication has been administered. An increasing amount of drugs of the hypnotic type is being employed. Some of these have quite a depressing effect on the respiratory system and necessitate a definite decrease in the amount of the anesthetic

agent required to secure the desired plane of anesthesia; all of which must be taken in consideration with each case.

The type of patient will also have much bearing on the anesthetic problem. In the obese patient with a short neck there is a greater danger of respiratory failure. The age of the patient is of great importance, as the most serious form of heart disease, with regard to anesthesia, is that occurring in the aged. Because of the hardening of the arteries the heart muscle cannot stand a lowered oxygen content of the blood; thus cyanosis in the old is particularly dangerous, requiring that the anesthetist be constantly on the watch for such a condition. The toxic goiter patient; the septic patient; the patient with anemia; or the patient with a high temperature—each requires particular care and thus demands special attention from the anesthetist.

The responsible nurse anesthetist is not only competent—she is conscientious. She is constantly on the watch for any change in the condition of the patient; for this constant anticipation of danger during anesthesia may be the means of saving a life when a major operation is in progress.

With the welfare of her patient always in mind the nurse anesthetist must next consider her responsibility to the surgeon in charge of the case. The surgeon has a right to expect an efficient anesthesia for the good of his patient, and also in order that there be no unnecessary hindrance to the exercise of his own skill. Though the nurse anesthetist is directly responsible to the surgeon for the administration of the anesthetic and the type of anesthetic agent to be given each patient is usually decided by the surgeon, the anesthetist and the surgeon who form the team should be able to exchange ideas as to the type most desirable for certain cases. However, when the surgeon specifies the type of anesthesia to be used, the anesthetist should administer it to the best of her ability. The surgeon expects that she be so skilled in the administration of anesthetics that he may devote his entire attention to the operative field. He should be able to depend on her judgment and skill to the extent that he can forget the anesthesia and proceed with his work, knowing that his anesthetist is on the alert for any emergency and is prepared to handle it if such should arise.

On occasion the anesthetist must be able to advise the surgeon as to whether in her judgment the operation be continued or stopped. She must know when to suggest intravenous medication, stimulants, artificial respiration or any other supportive measures. Often it is the proper fulfillment of her responsibility which allows the successful termination of an operation. Though the surgeon assumes the full responsibility for the well-being of the patient, he must of necessity depend to a great extent on the help which he receives from his anesthetist.

In addition to the proper care of the patient, the surgeon expects a smooth anesthesia, a relaxed abdominal wall and an uneventful and rapid postoperative recovery from the anesthesia. To the anesthetist, one of the greatest problems in her work is the rigid abdominal wall. The surgeon who is in a hurry to begin the operation and does not allow sufficient time for the induction cannot expect a smooth, relaxed abdomen. Therefore for the benefit of both the patient and the surgeon, the anesthetist should have a voice in deciding when the operation should be started.

Another cause of abdominal rigidity is inadequate preoperative medication. Though in most cases the amount of preoperative medication is in the hands of the surgeon, the anesthetist should be free to consult with him as to the amount to be given and the advantages or disadvantages of certain doses in order that the best results for both patient and surgeon may be obtained. The problems arising between the anesthetist and the surgeon will find a readier solution when the two can meet on common ground, and the discussion will make for better teamwork, and a better end result for all concerned.

Another common cause for abdominal rigidity may be found in obstructed respiration and in this case the anesthetist can blame herself directly. When the air passage is obstructed a proper flow of the anesthetic agent is not maintained, with resulting anoxemia and rigidity. Before beginning any anesthesia the patient should always be examined for any factors that might interfere with respiration, and a clear air passage must be maintained at all times.

No more of the anesthetic agent should be administered than is required to maintain the required plane of anesthesia, but the anesthetist who through timidity or ignorance fails to keep the patient in the proper anesthetic plane for the operative procedure at hand and thus interferes with the skill of the surgeon, or prolongs the operation and the consequent time that the patient must be kept under anesthesia, fails miserably in her responsibility to both the surgeon and the patient.

In the third phase I consider the responsibility of the nurse anesthetist to herself. Of first consideration is her health. Due to the arduous, long hours and the strain of her work she should have regular hours for rest, relaxation and recreation. It is to her own advantage, and indirectly to the advantage of her work, that she have interests outside her profession so that she can get away entirely from all thoughts pertaining to hospitals or the ills to which man is heir. She should have regular outdoor exercise and an adequate vacation each year. In this way she can keep herself in the best of condition, with a mind alert to meet and deal with the problems that may arise.

It is to the advantage of the anesthetist professionally to keep abreast of current literature that deals with her work. It will be of benefit to visit other hospitals and clinics to observe the work done there. For the sake of her own progress and for the advancement of her profession she should be a member of the local and national associations and take an active interest in their work, and whenever possible she should attend the meetings. Such conventions afford opportunities for personal improvement, bring new methods to her attention, and allow her to discuss her problems with fellow workers. They enable her to make stimulating contacts and to return home with a new enthusiasm for her work and with the resolution to strive more earnestly for the perfection which we all seek.

ANESTHETIC EXPLOSION HAZARDS AND PRECAUTIONS

HELEN LAMB

Barnes Hospital, St. Louis, Missouri

Read at the seventh annual convention of the Mid-South Post Graduate Nurse Anesthetists' Assembly held in Memphis, Tenn., February 12-13, 1941.

While certain anesthetic explosions have achieved spectacular prominence, it must not be assumed that the problem presented is a sudden new creation. As a matter of fact the fundamental equation per se has faced our field in one degree or another for centainly thirty-eight years, since Murray in 1903 reported the ignition of ether, which was being administered by open drop method when an electric light was turned on.[1]

The drama and its motif are old. but new players introduced to the scene have brought with them modern complications which demand new understandings to identify them, and new skills to combat them.

To me, the subject of anesthesia explosion accidents is divided into two separate aspects, each of which must be considered as an entity. These aspects are first, the inflammable anesthetic compounds themselves and the techniques by which they are administered, and second, the sources of possible ignition, and the integrated methods inaugurated to combat them.

Considering first the anesthetic agents themselves; reference to suitable textbooks will establish the fact that nitrous oxide gas is non-inflammable at ordinary temperatures. I do not overlook the fact that at very high temperatures nitrous oxide decomposes into its component elements, nitrogen and oxygen, and that in such circumstance the oxygen set free will support and intensify any combustion that has already been initiated—but at the temperatures with which we come in contact clinically, nitrous oxide acts as a stable compound, of itself non-inflammable. To demonstrate this fact, I have more than once experimentally passed a stream of nitrous oxide over a red-hot cautery — always without untoward effect.

When nitrous oxide *plus oxygen* is administered in anesthesia, the mixture still merits the designation of "non-inflammable," as demonstrated by the experimental work of Hornor and Gardenier.[2] The accidents which in our literature have been attributed to ignition of mere nitrous oxide-oxygen, so far as I know have never been cleared from suspicion that they were in reality explosions of nitrous oxide-oxygen *plus ether vapor*—the ether possibly being present in the apparatus from earlier administration, in either that or some preceding case. Nor have those particular accidents been divorced from the possible accidental presence of oxidizable oil or grease in the equipment—highly dangerous components when high pressure oxygen is valved.

As we proceed to the consideration of ether vapor, which is so regularly administered as a part of nitrous oxide-oxygen anesthesia, we enter a field wherein all three of the potent agents generally used (ether, ethylene and cyclopropane) are inflammable and explosive — the differences between them being principally in the speed of propagation of flame when they are ignited, and the amplitude of

destructive expansive pressure which they exert as a result thereof.

Illustrative of these characteristics is the fact that as a result of the relatively slow velocity of propagation of the flame of ignited ether-air mixtures, accidents involving that combination have been known to result in merely local burns;[3] but that fact must not lead to a false sense of security, as many fatalities have resulted from ignition of mere ether-air anesthetic mixtures.[4,5] In fact, as far back as ten years ago, Pinson estimated that at that time in England alone, there were occurring probably one hundred ether anesthetic explosions every year.[6]

And when we turn from ether-air mixtures to ether-oxygen, or to ether-nitrous oxide-oxygen mixtures, we find wide testimony to many fatal terminations to ignition of such ether combinations.[7]

Obviously, all ether combinations must be catalogued as inflammable mixtures, and appropriate safety precautions observed during their administration.

The higher percentage of fatal terminations to ethylene and cyclopropane explosion accidents, is due to the higher velocity of their flame propagation. As a consequence of this characteristic, the combustion is rapidly communicated to all parts of the mixture, causing thereby the violently expansive force that ruptures respiratory areas which are pneumatically coupled to that distensive force through the breathing tube and mask. As a defense against that now recognized mechanistic aspect of past accidents, research is under way to devise means of mechanically preventing communication of those destructive pressure forces to a patient.

At this juncture the question might almost be asked, "When non-inflammable nitrous oxide-oxygen is available, why use inflammable agents such as ethylene and cyclopropane?"—but the superiority of these more modern potent gases for many patients has been established so definitely that such a question loses most of its point. As Morrill and others have pointed out,[8] the dramatic nature and emotional news value of these anesthesia ignition accidents have given them a prominence quite out of proportion to the relative infrequence of their occurrence, and to the low anesthetic mortality rate consequent to them. The earlier editorial statement of the Journal of the American Medical Association seems to still hold true, that "regrettable as is any case of death from explosion of anesthetic gases, explosion is still statistically one of the least of the hazards of anesthesia."[9]

To reduce that hazard, however, to a still lower percentage of incidence, the dangers must be realistically recognized and defended against by the inauguration of specific appropriate precautionary safeguards. Obviously, neither ether, ethylene nor cyclopropane should be administered in the presence of a live cautery.

INDUCTION

Ethylene should not be used to *induce* an anesthesia because of the amount of inflammable gas that would thereby be discharged into the room through the open exhaling valve, during the period necessary for establishment of unconsciousness. Instead, anesthesia should be induced by nitrous oxide-oxygen, replacing the nitrous oxide by ethylene only after unconsciousness has been established. After beginning administration of the ethylene, the exhaling valve should be permitted open only long enough to actually displace the nitrous oxide, and to establish anesthetic tension of ethylene in the blood. The anesthesia

itself should always be conducted by closed soda lime filtration method.

Cyclopropane anesthesia should be inaugurated by a brief *closed circuit* administration of nitrous oxide-oxygen, until the leak-free integrity of all connections can be verified (including that between the mask and face) before admitting any cyclopropane to the circuit.

MAINTENANCE

During the conduct of cyclopropane anesthesia, completely leak-proof contact between the patient's face and the mask must be maintained inviolably—and every connection and joint of the administrative mechanism must be scrutinized, to identify and remedy promptly any leakage. If a leak develops during administration, the flow of cyclopropane should be discontinued until a mechanically tight circuit can be demonstrated. No compromise in this regard could ever be justified if an accident should result. However irksome at the moment, a voluntarily imposed delay to the procedure is infinitely preferable to a preventable fatality.

If, during the administration of cyclopropane, necessity supervenes for removal of the mask, to insert an airway or an endotracheal catheter, the obturator valve at the mask should be first closed, to limit the amount of gas spilled into the room, to that which is within the mask at the time of its removal and that which the patient exhales. As an added minor precaution, the mask should be turned "face upward" for the period of time during which it stands removed. (Cyclopropane is heavier than air.)

SURGICAL CLOSURE

At the conclusion of either ethylene or cyclopropane anesthesia, the gases should be watchfully spilled through the exhaling valve at the soda lime cannister, and that spillway area specifically defended from intrusion by persons who are not electrically intercoupled with the machine and with the anesthesia group. Also, diffusion of the spilled gas to a concentration lower than its inflammable limit should be facilitated by purposely created air currents.

As the ethylene or cyclopropane is in that manner displaced from the anesthetic circuit when the surgeon begins his closure, nitrous oxide-oxygen should be administered with open exhaling valve to replace the ethylene or cyclopropane for the period of closure. The exhaling valve area should be protected against ignition, during this open exhaling valve "displacement" period.

DEANESTHETIZATION

After closure has been completed, brief deanesthetization with helium, oxygen and carbon dioxide should be effected, so that when the protective leak-free mask-to-face contact is discontinued, and the patient's respiratory tract thereby exposed to or directly connected with the room and its ignition hazards, those vital respiratory areas will be not charged with ethylene or cyclopropane, but instead with a non-inflammable gas mixture composed chiefly of helium and oxygen, with some carbon dioxide. If there is individual or institutional prejudice against carbon dioxide, the deanesthetization should be accomplished with helium and oxygen alone.

GENERAL

The greatest danger area during ethylene or cyclopropane administration exists within a radius of about a foot in any direction from a simple leak.[10] This distance extends to about two feet when the gases are discharged into the atmosphere through an open exhaling valve.[11] This latter

distance naturally varies with the amount or velocity of flow of the diffusible gas mixture so discharged through the open exhaling valve into the room. Obviously, the smaller the amount of such explosive gas spilled into the room, the less will be the area of the danger zone to which the gas extends before its diffusion reduces it to a concentration that is below its explosion limit.

But whatever the dimension, and wherever it may lie, there does exist within the room when inflammable anesthetic gases are administered, a danger area whose precise extent and location cannot with certainty be predicted. It is clearly necessary, therefore, that the safety precautions inaugurated must encompass within them all areas presenting ignition hazards to which the explosive mixture might extend. What are these ignition hazards, and how may they be safeguarded?

CURRENT ELECTRICITY

The literature is replete with explicit statements cataloguing the danger of ignition by sparks which originate from "current" or "live" electricity. The defense against spark ignition from that source lies in eliminating from electrical circuits any but approved lighting switches; and especially keeping all wiring and electrical equipment within the room in a state of complete repair, verifying all electric bulbs to be screwed tightly into their sockets, whether they be in lighting fixtures, in laryngoscopes or in head lamps. Head lamps should be lighted by a current whose potential is not higher than 6 volts.[12] The glaring ignition danger which is presented when personnel either inserts into a wall socket, or pulls from a wall socket, the plug of a lamp or other electrical device while it is lighted or while its switch is in the "turned on" position, is clearly recognized. Such a practice should be strictly prohibited.

STATIC ELECTRICITY

Sparks from *electrostatic* sources (and these have been the principal causes of recent ignition accidents) call for quite different defensive precautions. These have been so widely and clearly stated in the literature, that to do more than mention them here would be mere repetition. But some phases still invite elaboration.

As an introduction to that aspect, let me remind you that when two or more objects (including persons), carry electrostatic charges that exist at different potentials in one than in the others, they may cause an igniting electric spark if brought into contact with each other.

Therefore, stated simply, the elimination of dangerous sparks from this source resolves itself into either preventing all such unequally charged objects from coming into contact with each other (a manifestly impractical thing to do) or else bringing to a common electrical potential, all such objects that are disposed within the area which is to be protected—and then keeping them at a balanced potential with each other for the duration of the procedure. This maintenance of electrical balance implies "equalization" or "dissipation" among those objects, of such electrostatic charges as may be generated by frictional activities of personnel within the room or who enter the room, during the procedure.

This continuous electrical bonding may be accomplished effectively for the direct anesthesia group by means of the Horton intercoupler, which embraces within one balanced intercouple, anesthetist, anesthetizing machine, operating table and one other person or thing (usually anesthetist's

assistant, or the ground).[10] It is urged that no ethylene or cyclopropane anesthesia be undertaken without the protection of either this safeguard or its full equivalent. The recently proposed conductive rubber breathing bags, tubes, and connections for anesthetizing machine, will add to the completeness of the electrical bonding of this group (which embodies the focal point of the danger zone,) when they are perfected to a satisfactorily low resistance value throughout their entire dimension.

The ultimate desideratum, of electrical bonding of all objects within the room, is contributed to by the maintenance of a very high relative humidity (55 to 60 per cent) when the atmosphere of the room has not been depleted of normal carbon dioxide, or of some other electrically conductive component, by "washing" during air conditioning.[10, 13, 14] In this connection it is to be remembered that experiment has indicated that the air's moisture or humidification must carry carbon dioxide or some other essential substance, if it is to conduct or dissipate electrostatic charges satisfactorily. This factor seems to have escaped recognition during earlier years, when the successful avoidance of explosions in certain industries was credited to merely the humidity, rather than to the association of some electrically conductive component with that moisture.[15]

At this point I call attention to some pitfalls which, if not recognized and avoided, might result in appreciable errors in appraising the true humidity of an operating room that is relying on high humidity for electrostatic protection. The stationary wet and dry bulb hygrometers frequently employed to indicate prevailing conditions of relative humidity may introduce errors up to 15 per cent, if not fanned vigorously immediately before reading, and if not "read" quickly and accurately immediately the fanning ceases. It is important that relative humidity safeguards should not be based upon the indication of these instruments, unless such vigorous air movement is maintained for a sufficient period of time to bring the reading of the wet bulb thermometer to a stationary level.

A stationary instrument whose indicating mechanism is actuated by a *hygroscopic* element, such as human hair, does not require air circulation for accuracy of indication, but does require calibration at regular intervals with a correctly operated wet and dry bulb apparatus. When regularly serviced and calibrated, however, such instruments yield results of satisfactory accuracy.

While we at Barnes use both hygroscopic and dry and wet bulb instruments, I prefer for routine use an *air aspirated* psychrometer, equipped with red liquid thermometers that have been matched for accuracy, and carrying a manually operated aspirating mechanism. Such instruments are simple to operate, yet yield the accuracy of sling psychrometers without their awkwardness of manipulation.

In addition to high humidity for electrically bonding all objects within the operating room, two "positive" methods are available. The first of these is the long established system of brass floor grids installed as a part of the terrazzo flooring. The second is the more recently proposed flooring made of special composition "electrically conductive" rubber.[16] Both the brass grid and the conductive rubber flooring imply directly bonding to them all equipment within the area, by means of fine meshed drag chains or other conductive materials; but both systems exhibit the same shortcoming, namely, they do not actually include within them the circulating

personnel (either staff or visiting) when such persons are insulated from those conductive floorings through the interposition of electrically non-conductive shoes.

Until early last year, conventional leather soled shoes were felt to be "satisfactorily conductive" when worn on a conductive rubber flooring[17] but preliminary tests made for our department, and later tests made by our department, developed the fact that different pairs of leather soled shoes yielded great differences in their degree of conductance; and that a given pair of shoes which presented one conductance value at one time, exhibited quite a different conductance value at another time. These findings were communicated to Professor Horton, in charge of investigations at the Massachusetts Institute of Technology.[18]

It is now recognized that conventional leather-soled shoes present such variations in their properties of electrical conductance under different conditions of usage (related chiefly to variations in moisture content), that until some dependable shoe of permanent conductivity is devised, the only assurance that personnel is actually intercoupled through the medium of a flooring, lies in electrically testing each pair of shoes at the time it is being worn for service.[19] Ordinary "composition" soled shoes and conventional rubber-soled shoes, are definitely non-conductive and should be excluded from use. In this connection I may mention that our department of anesthesia at Barnes has been experimenting for some time with several designs of electrically conductive shoes, and expects to have something of interest to announce in the near future.

Summary:

During the administration of inflammable anesthetic combinations of ethylene, cyclopropane, or ether plus nitrous oxide, there exist at times and at places within the operating room, explosive mixtures which may be fired if subjected to sources of ignition.

The hazard of such accident is reduced by (a) restricting to a minimum the frequency and amount of spillage or discharge of such mixtures into the room, (b) excluding from the room during such administration, the use of cautery or other known source of ignition, (c) inhibiting the production of "current sparks" or "static sparks" within the area.

The hazard from sparks of current electricity origin, may be controlled by maintaining in a state of complete repair, all electric wiring, sockets, connections and ignition-proof switches; by preventing the "opening" or "closing" of live electric lighting circuits or power circuits during the administration; by limiting the voltage used for head lamps.

The hazard from sparks of electrostatic origin may be combated by electrically bonding with each other all objects (including persons) within the area to be safeguarded. The missing link to such a general intercouple system is a suitable shoe for duty service by the personnel (including surgical, anesthesia, circulating and visiting) that will exhibit permanent conductivity of electrostatic charges of the order met with clinically. Experiments with service shoes that are electrically conductive, are now under way.

Bibliography

1. Murray, Dwight H., The Lancet, July 25, 1903, p. 277.
2. Hornor, A. P., and Gardenier, Clyde, B., Anesthesia and Analgesia, March-April, 1928
3. Horton, J. Warren, Bulletin Am. Ass'n of Nurse Anesthetists, Nov., 1940, p. 286

4. McKesson, E. I. (Discussing Blomfield, J.), Proceedings Royal. Soc. Med., Section on Anesthetics, July 13, 1926, pp. 39-49
5. McDonald, N., British Medical Journal, Oct. 17, 1925, p. 713
6. Pinson, K. B., Brit. Med. Jour., Aug. 30, 1930, p. 312
7. Livingstone, H., Shank, I., and Engel, R., Hospitals, July, 1939, p. 44
8. Morrill, Warren P., Bulletin Am. Ass'n of Nurse Anesthetists, Nov., 1939, p. 302
9. Editorial, J.A.M.A., Feb'y 9, 1929, p. 476
10. Horton, J. Warren, Paper presented before Am. Soc. Anesthetists, April 14, 1939
11. Cheney, Merle B., and Folkman, M. L., Anesthesia and Analgesia, Jan., Feb., 1930, p. 11
12. Morrill, Warren P., paper in preparation.
13. Woodbridge, Philip D., Horton, J. Warren, and Connell, Karl, J.A.M.A., August 26, 1939, p. 740
14. Buchman, M. A., and Wardell, C. W., Research Dept., Ohio Chemical & Mfg. Company
15. Nat'l Fire Protection Ass'n, Report of Committee on Static Electricity, 1937
16. Horton, J. Warren, Laboratory of Biological Engineering, Mass. Inst. Technology, Oct. 20, 1939
17. Horton, J. Warren, personal communication, March, 1940
18. Personal communication, May, 1940
19. Horton, J. Warren, Bull. Am. Ass'n of Nurse Anesthetists, Nov., 1940, p. 291

THE PROGRESS OF THE NURSE ANESTHETIST

MIRIAM G. SHUPP

Strong Memorial Hospital, Rochester, N. Y.

Read at a meeting of the Michigan Association of Nurse Anesthetists, on February 22, 1941, Detroit, Mich.

There is a word in the dictionary, the definition of which is "persistent," "to urge with frequent application." This word is "importune" and it may be applied to much of what I am going to say. I am convinced that there are many problems which concern us as nurse anesthetists that should be brought before our groups repeatedly. Excellent articles along these lines have already been published in our Bulletin, such as Mr. Hamilton's "Building Esprit de Corps," Mr. Flash's "Organizational Activity," and several papers on the organization of an anesthesia department.

The nurse anesthetist today has a twofold obligation: first — to the hospital, the surgeons, and the public she serves; and second — to all other nurse anesthetists, or in other words, to the organization of which she is a member. She cannot function any more merely as an isolated individual -- the organization of the group has changed that.

Whenever I hear criticism of a nurse anesthetist, either from a professional or personal standpoint, it is always my reaction to take this rather personally. I am vitally interested in each anesthetist's success or failure in her post, even though she may be unknown to me. The percentage of the individuals in our group who are, or are not filling

their positions efficiently and successfully is of vital concern and consequence to you and to me. The nurse anesthetist has without question made a place for herself in the medical and hospital field, but whether or not she continues to hold that place depends solely upon her own continued efficiency and progress. The time in which we are living is not one of repose and no amount of wishful thinking can make it so. We happen to be living at a time of upheaval and rapid change, and equally rapid scientific advances.

We have chosen as our profession first, nursing, and then anesthesia, and it is needless to point out to you the rapidity of the changes in this field — advancement and changes that are coming so rapidly that in order to continue to live progressively, vitally and effectually we must live in the "Red Queen's" country and copy her pattern of behavior. You remember the Red Queen in "Alice in Wonderland." In one of Alice's adventures she had Alice by the hand, running as fast as she could and urging Alice to run faster and faster. Finally Alice dropped exhausted to the ground, and looking around her in surprise, exclaimed that they had stayed under the very same tree the whole time they had been running and the Red Queen said, "*Of course,* what *would you* have it?" and Alice said, "Well, in our country you could usually get somewhere if you ran as long and as hard as we did," and the queen remarked that that was a slow sort of country and said, "Now *here* you see it takes all the running you can do to stay in the same place."

The nurse anesthetist in the larger institution should doubtless find it much easier to keep abreast of new developments. In the smaller institutions, where there is only one anesthetist (and 72 per cent of our hospitals have one hundred beds or less) she must rely on her own initiative in order to make progress, while in the larger place there is the advantage of numerous daily contacts and the resulting stimulus from others who are doing the same kind of work, and where possibly research and teaching are being done. The average small hospital presents advantages, however, that are not found in the average large institution: more free time for study; for contacts with patients; for knowing co-workers better; and an opportunity to wield a greater personal influence. Those of you who are working in the smaller hospital should make every effort to attend your organization meeting, state, regional or national — even though the time must be taken from the vacation period. The alert, wide-awake anesthetist should be able to prove to every right-thinking hospital administrator that time granted to her for attendance at meetings is a sound investment. Mere attendance, however, is not enough — participation is essential; our interests and our energies go hand in hand.

In the larger centers where a number of anesthetists are employed, periodic meetings of the staff are essential, for the study of departmental problems. The program should include an assigned subject of current interest for discussion and a review of current literature. The coverage of certain periodicals should be the routine responsibility of the various staff members so that by group effort all current literature is reviewed. These meetings should be a definite part of the organization of the department.

Every department of anesthesia should and can be well organized. In my opinion, however, this is not possible unless one person is appointed to be responsible for the department. There should be an outline of duties and responsibilities for the department as a whole, and for the members of the

staff. The departmental organization should include a schedule for each anesthetist's time. Doing a type of work which necessitates covering the department twenty-four hours of the day, entitles every anesthetist to definite stipulated free periods that she may plan on in advance — barring, of course, the unforeseen. We must never lose sight of the fact that we are a professional group and not clock punchers—nor would we wish to be. The anesthetist who is to be on call, let us say over the entire week-end, should nevertheless feel relatively certain that she will be free for a dinner engagement on Monday evening.

A detailed and comprehensive system of records is necessary in any institution. If one is fortunate enough to have a statistical department in the hospital that does this — fine, but if not, these records should be kept by the department, and should include a tabulation of the daily cases, with a resumé of the month's work. The total number of anesthesias should be broken down into the various types of cases and anesthetics used; the number and kinds of complications and any deaths; supplies purchased and replacements; a computation of the amount of gas used, with the average consumption per case or per hour of anesthesia. The department should develop a system of follow-up of patients, including detailed data on postoperative pulmonary complications and complications attributable to the anesthesia. Written reports of accidents and fatalities should be made out by the anesthetist on the case, the signed original retained in the Anesthesia Department and a copy sent to the administrator or the excutive to whom the department is responsible.

An annual report should be compiled from the monthly reports, and it should be the responsibility of the anesthetist in charge to see that the individual to whom the department is responsible receives a copy. In the annual report should be included a list of changes in personnel, days of illness, and special activities: — for instance, participation of members of the staff in the activities of the state, regional or national organizations, as officers or committee members; attendance at state or national meetings, and as speakers on the various programs; and any other departmental activity.

The set-up of the department should include, if possible, a salary schedule. This can be based on either a determined increase in salary at stipulated times, or on the merit system, there being advantages and disadvantages to both. Each member of the staff should be acquainted with the policy of the hospital relative to sick leave and vacation time allowed.

When a new anesthetist is employed, there should be an understanding as to what she may expect and what is expected of her. These points should have been fully and clearly stated, either in a personal interview or by letter. She should be given responsibility for definite routine assignments, but in addition she should be made to feel her responsibility for the general care of the department in which all must share. Departmental routine and policies should be outlined to her, and it should be emphasized that she must get along well with all those with whom she is to work. If the one in charge of the department is coöperative, however, she can expect coöperation from her staff and from other members of the hospital personnel. If the department head is loyal, fair, tolerant and kindly, these qualities will be more in evidence in those with whom she has contacts. Also, her attitude toward the patient and the care taken in regard to the patient's comfort and well being, will be emulated not only in the Anesthesia De-

partment, but also through the staff by others who come in contact with the patient in the operating room, or on the division.

Who of you has not had the experience of having a near-fatality, let us say from lack of understanding on the part of the nurse of the evaluation and importance of a patent airway during the period of recovery from anesthesia? Do you have the opportunity of returning your patient to the division, and if so, do you take the time at the patient's bedside to teach and explain the possible complications in individual and unusual cases? Do you have the opportunity, or have you given consideration to asking for the opportunity, of talking to student and graduate nurses in regard to the postoperative care of patients during the recovery period? If you are working in a hospital where a school of nursing is maintained, have you ever discussed the subject with the surgical nursing instructor to find out whether your teaching and her instruction coincide? If they do not, it is confusing to the student and indicates a lack of proper coöperation and understanding between two important departments. Seek opportunities to discuss anesthesia with groups of student nurses or graduates, particularly in regard to the immediate postoperative care of the patient. It will pay dividends in better and more intelligent care of the surgical patient, and furthermore, it is good public relations for the nurse anesthetist.

Resuscitation of all patients, including the new born, oxygen therapy, intravenous anesthesia, intratracheal anesthesia — all may be responsibilities given to the anesthesia department. Do not shirk the responsibilities that you are asked to assume that come within the province of the nurse anesthetist; invite and welcome such opportunities and make yourselves proficient. You should not be asked, however, to shoulder additional responsibilities that cannot be handled efficiently from the standpoint of number of personnel in the department. I feel that it is the duty of a department head to discuss freely and frankly with the individual to whom she is responsible, all matters over which she has no direct control that interfere with the good service to the patient that may be rendered by the anesthesia department.

I should like to discuss some points in regard to our organization. Dr. Morris Fishbein, in a recent issue of the Journal of the American Medical Association, says that "At the turn of the century, medical education in the United States was chaotic." It is not surprising, then, that this statement has also been made in regard to anesthesia.

Let us review a few facts in regard to the history of the anesthetist. The first nurse anesthetist was Miss Alice MacGaw, who was employed at the Mayo Clinic in 1892. Today 2531 hospitals are using nurse anesthetist service, but for forty years the nurse anesthetists were unorganized, inarticulate for the most part, and with few outstanding exceptions, her influence did not spread beyond the confines of her own particular institution. Because of the nature of her work, she was not primarily interested in nursing activities and nursing organizations, and she was as a result an isolated individual or a member of a small isolated group. She lacked the benefits of group endeavor and contact with others in the same field of service. The only exceptions to this state of affairs were the schools of anesthesia in which nurses were receiving their training.

Miss Agatha C. Hodgins was one of the pioneer nurse anesthetists who realized what continued lack of organization would mean to the future of the

group, and with forty-nine other anesthetists founded on June 17, 1931, the National Association of Nurse Anesthetists. The objectives of the organization were to place increasingly better qualified people in the field; to keep those already in the field abreast of modern developments; and to give protection and recognition to this group of professional workers.

The first national convention and the printing of the first Bulletin occurred two years later, in the fall of 1933. I will venture to say that few of those present at the first annual meeting were familar with the technicalities of organization or parliamentary procedure. This is likewise true of the majority of us who have become active in the work of the organization since that time. I feel, however, that each of us who has accepted responsibilities in either the state or national organization and has executed those responsibilities to the best of her ability, has gained far more than she has given.

This service to the organization has meant giving up valuable personal time; it has meant learning coöperation in group activity, to think objectively, and to study our own professional problems, organization set-up and parliamentary law. For many it has even meant learning to use a typewriter and a system of bookkeeping. It has given us, however, unlimited opportunities to know our own group and to evaluate the work of the nurse anesthetist; and in the preparation of convention programs and other activities it has afforded us contacts with hospital administrators and outstanding people in the medical profession. It has given us experience in the writing of papers for state and national programs. The necessity of learning to speak before a group and to take part in group discussions has developed latent talent along this line. These are only a few of the benefits of organization aside from the fundamental purposes for which the organization was founded.

We have been charged from certain quarters with moving too slowly. The criticism regarding the slowness in raising standards may be partially justified. Any apparent lack of enterprise has not been due to inactivity or laxity but rather from adherence to the old adage, "Make haste slowly."

The Association program is one embracing coöperation between the hospitals, the schools of anesthesia, and the national organization. A recommended curriculum for schools of anesthesia for nurses was adopted by the Association in 1934, and at the present time it is being revised. The present curriculum recomends a six months course as a minimum, but advocates a year of training. At the time of its adoption a number of hospitals were giving a four months course in anesthesia, but by September 1940, when the By-Laws were revised and set as a minimum requirement for active membership graduation from a six months course in anesthesia, only one school remained that was giving a four months course. Upon notification of increased requirements for eligibility to membership in the Association, the physician in charge coöperated fully with the Association and within two months increased the course in his school to six months.

Since the adoption of the curriculum in 1934, a number of schools have voluntarily extended the length of their course beyond six months and they have also instituted improvements in their curriculum. While our program does not contain anything compulsory so far as the schools are concerned, definite standards for membership in the organization have been set and will be raised as indicated. For active membership these standards at present include a six months course of instruc-

tion in an organized school, with a certificate from the school, or six years experience in anesthesia prior to 1939.

In formulating any new regulations, it is necessary to have a large group conforming to certain principles, and it is therefore the policy of the organization to encourage all schools to give the course of training that will entitle their graduates to Association membership as the membership requirements are advanced.

A study of the schools of anesthesia has been made by means of a questionnaire. A personal fact-finding survey of the schools is now under way in the national organization, and it is expected that a report of this survey, including the tabulation of findings, will be ready for the next annual convention. This should be interesting and should give us much food for thought.

The program of the American Association of Nurse Anesthetists is, in its entirety, a coöperative program with the schools of anesthesia, the hospitals and the medical profession, and its fundamental aim is to increase the value of nurse anesthetist service. The organization has a twofold purpose: first, to assist the schools in better training of students, and second, to protect our membership and insure to those who employ our members that they have certain definite professional qualifications.

Undoubtedly a system of examinations for applicants for membership in the organization will come within a short time. On a coöperative basis with schools of anesthesia, this could also be made to function as the final examination for the student who is about to be graduated from the school of anesthesia. I have covered the subject of examinations and registration at length in my annual report of 1940 as President of the Association.

Today, possibly as never before, the subject of human relationships is being discussed, occasioned no doubt by world conditions — wars, depressions, and economic and political disorder. Frank Walzer in his "Art of Conference" says, "There are more and more tasks today at which men can no more create alone, but must create and plan together. To meet conflict intelligently and to rise above it is really the essence of the art of living. Discussion is far more than a means to collective action or to intellectual agreement. It discloses the degree to which the art of living is realized by each one who participates."

Some time ago I attended a state hospital convention and participated in a panel discussion on "Hospital Administration Practices." One group of professional employees was gnawing a bone of discontent because they felt that they were not being accorded proper professional consideration. The coördinator of the panel frankly stated that the reason probably rested with them. We must bear in mind that as individuals, or as a group, we cannot command respect or recognition just because we *think* it is our due. Respect and recognition are the end-results of right effort. This is the law known as action and reaction, or cause and effect. The measure of respect and recognition accorded us individually, collectively or as an organization is no exception to this universal law, but will be given us now and in the future, in proportion to our sincerity and the worth of our motives and our efforts.

I ran across an essay on "Work and Effort" by a man named Wagner and I should like to quote a bit of his philosophy. "I know of nothing finer than a man who loves his work, who feels the poetry of it, its peculiar charm, and gives the impression that he believes in it while achieving it. We call this working with conviction. To those who look at their work only from

the outside, on the material and often commonplace side, it appears to them gloomy and commonplace. It seems to have no meaning. We *must* look at it from the inside. We must try to penetrate sufficiently far into our career, our vocation, to perceive there the forms which from without seemed dim, the effects of a light which falls from the eternal heights. The soul of creation only reveals itself to the toiler and he comes to understand a motto which the wisdom of the centuries has found, that is, 'Work and hope'."

PERMANENT VALUES IN ORGANIZATION

AGATHA C. HODGINS

Chatham, Cape Cod, Massachusetts

Read at the seventh annual convention of the Mid-South Post Graduate Nurse Anesthetists' Assembly, held in Memphis, Tenn., February 12-13, 1941.

It is conceded that the force motivating organization is realization by a group of persons concerned with a common cause, that the cause is of such importance that they are united in the will to work for the attainment of certain objectives, which constitute its basic life and may be best attained and more securely guarded by forming an association. Such an association to be designated by a certain name and given distinctive organizational form. This form may be simple in type and local in action or more complex in form and national in scope and action.

The permanent value of such an association will depend on the enduring quality of spirit which dominates it and on the ability of its leaders to formulate with vision its intellectual content. This combination of spirit and mind constitute the *content* of its organizational life and determines the *form* through which such qualities of spirit and attributes of mind will work together in attaining the objectives of service for which the association was founded. The content is greater than the form, but the form is necessary as a vehicle or medium for giving outward expression and action to the inward and spiritual life of an organization. The permanence and enduring value of an association therefore depends on the spiritual qualities which guide its intellectual life and on the form of concrete service to humanity produced by its mental processes and given living expression through its organizational pattern.

On the order of this premise our first question is—What are the qualities which make an organization of permanent value? Our answer may well be—the same qualities, greatly multiplied and more widely expressed, which give to human beings their element of greatness. In the order of basic value these are—faith, courage, endurance, patience, justice, honor, tolerance and incorruptible integrity of mind and heart. All persons devoted to bringing about by individual or coöperative effort, greater good to a greater number of people, have within themselves in varying degrees, these essential elements of the spirit. The important thing, to an organization, is that each individual member cultivate to a greater degree than now possessed, these qualities, for upon the exercise of such depends both spiritually and practically the success of any great undertaking—and an association devoted to advancing a work of *vital* importance to human-

ity *is* a great undertaking and *has* enduring value.

Such qualities of the human spirit therefore, if made the motivating force to guide that other component part of the organizational content—the mind, will result in a well thought out and carefully planned course of action. A plan that will include and embrace practical consideration of all the factors which naturally constitute the pattern life of the association. A plan in which appointed leaders, entrusted with the responsibility of guidance, will not only visualize clearly the present needs of the organization, but will have within their minds a fuller vision of latent potentialities of interest and talent to be discovered, fostered and used in furthering essential objectives which the association stands committed to accomplish.

To execute such a program effectively implies the exercise of sound judgment in the organizational setup adopted. It implies knowledge of intrinsic values and external form which organizations following democratic principles have been founded on and function upon. It assumes that chosen leaders will think clearly, act decisively and reasonably, when crises arise which interfere with effective functioning of the association or threaten its welfare. It implies that in such controversial issues, while the primary influencing factor will be what decision best protects the *general* good of the organization; there will also be recognition of the fact that most differences can be resolved, without loss of friendliness, by the exercise of good will on both sides. It implies that there will be realization by leaders that their most difficult and most important task is that of blending the diverse reactions and opinions of a membership, into a harmonious concept of thought and translating that concept into a program of useful service for the common good.

These qualities of leadership, however, constitute only one-half of the spiritual and intellectual content of the life of an organization; and must be complemented and completed by the other equally important half—the spirit and intellectual gifts of the membership.

The membership is the permanent part of an organization—officers and trustees change at the end of their tenure of office and return to the membership—but the membership remains its constant force. If the membership fails the organization—the organization fails and dies. If the membership steadfastly and enthusiastically support and work for it—the organization flourishes and grows strong; therefore the greater responsibility belongs to the membership and must be so assumed. It is the plain duty of each individual member to work for and support, to the limit of her ability, state and national projects instituted to advance the welfare of the organization and give full expression to its ideals of service; this is why associations are founded—this is why they should be loyally supported. No matter how devoted leaders may be—no matter how capable, enthusiastic and self-sacrificing they may be; that ability, devotion, enthusiasm and unselfishness cannot too long endure and struggle against the spirit of apathy and selfishness of an indifferent membership. It is definitely the duty of the membership to prevent this by cultivation of deeper loyalty and by exercise of appreciation for and cooperation with those who are their chosen representatives. There is also needed cultivation of that old-fashioned spirit called *duty* which meant —when I was taught it—assuming

responsibility for carrying your share of a load, or undertaking your part of a job—doing your best with it and sticking to it, no matter how hard the going, until it was done. A plain virtue but a grand character builder, and in organizational life "its price is above rubies."

Harmonious fusion of these two component parts into one governing force is necessary before the form of organization, best suited to serve the needs of the work it represents, can be *truly* created. This force, if motivated by high spiritual qualities and guarded by intellectual integrity, will soon become a dynamic influence in opening up new avenues through which the organization will expand and become of enduring value. And never has there been a time when useful service is of such paramount importance. Never so great the need —never so imperative the duty to guard and sustain organizations founded on democratic principles and devoted to the welfare of humanity.

Specifically—as concerns ourselves, never in its history will greater demands be made upon a profession, to which as a branch of service our organization belongs—and by right of belonging must do its full share. This then is the object of my theme —imperfectly expressed because dealing with imponderables of spirit—as difficult to value as light or air, but like light and air, necessary to our life—and which if contemplated in our minds and absorbed into our hearts will give courage to our actions, endurance to our spirit, and make the work we do a benefit and blessing to those for whom it is done. And for whom and why is this effort made? What is the underlying cause that prompts this labor, with its often heart-breaking difficulties and disappointments? The answer is because of our faith in the inherent greatness of man and our passionate belief in his right to freedom and happiness. Here—because my words seem much too inadequate, I am substituting for my own expression a quotation from an article some of you may have read, but which to me so conveyed the eternalness of this wellspring of democracy that I now give it to you, hoping you too will make it part of your mental life and when things grow discouraging you may recall it to your mind and feel refreshed and heartened. I quote:

> * "And since the belief that man is great is the very basis of democracy, and the only justification for human freedom, one needed no longer to speak of "democracy" or "freedom." One was living and dying for the essence, not the word; for the content, not the form.
>
> "The morale of a democracy, the only form of society which is based on a transcendental faith in humanity, must arise out of that faith—out of a passionate love for all the things that man at his best has apprehended and expressed, whether in the fields he has tilled, the gardens he has planted, the cities he has built, the words he has uttered or the songs he has sung. It must arise out of the passionate conviction that humanity will one day till wider fields, plant better gardens, build lovelier cities, utter greater words, sing nobler songs. When people feel these things, though democracy is threatened by all the hosts of hell, it will defend itself. And if it falls in one place, it will rise again in another."

Is this not worth all our striving —all our labour? "Sic vos non vobis" —thus not for yourselves you labour.

---

* Thompson, Dorothy, "Defense and Morale."

DEPARTMENT OF EDUCATION

ARTERIAL BLOOD PRESSURE

HAROLD D. GREEN, M.D.[1]

Associate Professor of Physiology, Western Reserve University Medical School, Cleveland, Ohio

Maintenance of an adequate arterial blood pressure is essential for providing a proper circulation of blood through the body. Since many serious disturbances of body function seen in the operating room are accompanied by changes in arterial pressure, it is important that the anesthetist know how to measure the arterial blood pressure and how to interpret any abnormalities that may be observed.

GENERAL CONSIDERATIONS. The circulatory system is composed of the serially connected systemic and pulmonary circuits. Since these two circuits are similar, a brief description of the systemic circuit only will be given. The systemic circuit consists essentially of (1) the heart which, operating as a pump maintains the circulation of the blood, (2) the aorta and large arteries which serve to distribute the blood to the various parts of the body, (3) the predominantly muscular-walled arterioles which, serving as stopcocks, control the amount of blood delivered to the capillaries with which they are connected, (4) the extremely thin walled capillaries which provide for exchange of substances between the blood and the tissues and (5) the veins which serve to collect the blood from the capillaries and return it to the heart.

By virtue of the elastic nature of their walls, the aorta and large arteries also serve as a storage and pressure equalizing chamber, receiving blood from the heart intermittently (during ventricular systole), but passing the blood on to the capillaries in a fairly steady stream.

The heart builds up pressure within the aorta and large arteries by pumping blood into them and thus stretching their walls. This pressure serves to drive the blood through the arterioles, capillaries and back to the heart again. In overcoming the resistance to flow offered by these structures the pressure is progressively reduced. In an average subject the pressure in the aorta would be around 100 millimeters of mercury. In flowing from the heart to the arterioles the pressure of the blood falls only a few millimeters, but as the blood passes through the arterioles into the capillaries it must overcome a high resistance to flow so that by the time the capillaries are reached the pressure is around 35 millimeters of mercury. In flowing through the capillaries the pressure falls to about 10 millimeters and finally drops to around zero when the blood has returned to the heart.

ARTERIAL BLOOD PRESSURE is the pressure of the blood while it is in the aorta and large arteries. The magnitude of this pressure is dependent at any moment upon the amount of blood within these structures, and the degree to which this quantity of blood stretches their elastic walls. It is governed by the pumping action of the heart which forces the blood into the aorta, and by the resistance to flow of blood out of the aorta through the arterioles. Increased pumping action of the heart or greater resistance to

[1] Formerly instructor of physiology, School of Anesthesia, University Hospitals, Cleveland, Ohio.

flow of blood out of the aorta, either of which increases the quantity of blood in the aorta and large arteries, will increase the arterial pressure. Conversely, diminished pumping action by the heart or decreased resistance to flow of blood out the aorta will decrease the quantity of blood in the aorta and large arteries and therefore lower the arterial pressure.

SYSTOLIC, DIASTOLIC, MEAN AND PULSE PRESSURE. The elastic chamber formed by the aorta and large arteries contains about 200 to 300 cc. of blood. During systole about 60 cc. of blood is ejected into the aorta by the heart. Part of this 60 cc. of blood flows out of the aorta through the capillaries during systole, but the greater part flows out during diastole. Thus, while a considerable quantity of blood is always present in this elastic chamber, the volume present increases with each systole of the heart when blood enters faster than it leaves, and decreases during diastole when blood continues to flow out, even though none is entering. As a result, the arterial pressure rises to a maximum called the systolic pressure during contraction of the heart when the volume of blood in the aorta is increasing, and falls to a minimum called the diastolic pressure during the relaxation of the heart when the volume of blood in the aorta is decreasing.

The difference between the systolic and diastolic pressures is called the pulse pressure. Since the degree of stretch of the aorta with each systole is dependent upon the amount of blood ejected by the heart, the pulse pressure may, in general, be taken as an index of the stroke volume of the heart. If a large volume is ejected the systolic distension of the aorta and large arteries, and therefore the pulse pressure, will be considerable, whereas if the volume ejected in a given systole is small the converse will be true. This cyclic expansion and collapse of the arteries with each heart beat is responsible for the pulse which is felt when an artery is palpated.

Because of the considerable quantity of blood always present in the aorta and large arteries it is possible to speak of an average or mean arterial pressure, approximately half way between the systolic and diastolic pressures, which indicates the average force with which blood is driven to all parts of the body.

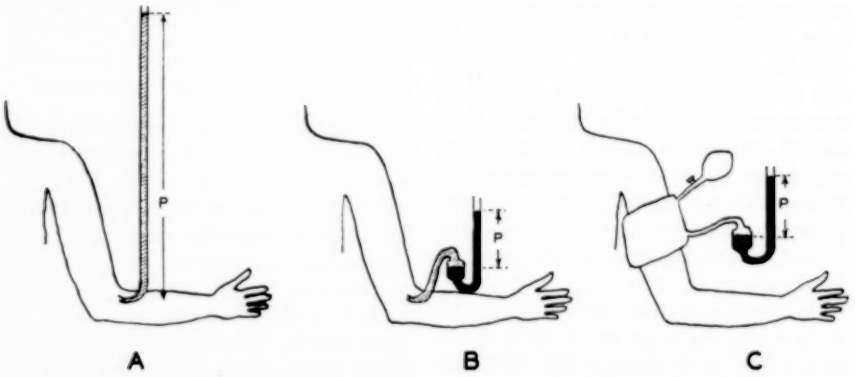


Figure 1. Methods of measuring blood pressure. **A**—by allowing the blood to rise in a vertical tube connected with the artery, P = pressure in cm. of blood. **B**—by connecting the artery with a mercury manometer, P = pressure in mm. Hg. C—by use of the sphygmomanometer, — = pressure of air in cuff in mm. Hg.

MEASUREMENT OF ARTERIAL PRESSURE. (See Figure 1). One is made aware of the magnitude of the arterial pressure by the distance blood will spurt when an artery is cut accidentally. This pressure could be measured by connecting a vertical glass tube to the artery and measuring how high the blood would rise in it. An average figure would be 125 centimeters. One might also connect the artery to one arm of a mercury manometer, as is done in the laboratory and measure the difference in the heights of the two mercury surfaces. A pressure of 95 millimeters of mercury would correspond to the above pressure of 125 centimeters of blood, mercury being about thirteen times as heavy as blood.

In patients, blood pressure is more conveniently measured by means of the sphygmomanometer. This instrument consists of a flattened rubber balloon incorporated in a cuff which is wrapped around the arm of the patient, a rubber bulb for inflating the balloon, a manometer for measuring the pressure of the air within the cuff, and a valve for slowly lowering the pressure by allowing the air to escape. When measuring the arterial pressure, the pressure in the cuff is raised to a level higher than the systolic arterial pressure, thus completely compressing the brachial artery and stopping blood flow in it. The pressure in the cuff is then gradually lowered, while palpating the radial artery to detect the first pulsation, or while listening with the stethoscope for the sound created by the blood as it suddenly begins flowing into the collapsed artery below the cuff. By the latter method a series of several changing sounds are heard as the cuff pressure is lowered, which may be divided into several phases. In the first phase the sounds first become evident, in the second phase the sounds become louder and a hissing murmur may be added, in the third phase they consist of loud thuds and in the last phase these sounds suddenly fade and disappear at the end of the phase.

The explanation of these sounds is as follows: When the cuff pressure falls slightly below the systolic arterial pressure blood will begin to spurt through the brachial artery with each beat of the heart, but the flow will cease each time the arterial pressure falls below the cuff pressure. This momentary flow of blood with each heart beat gives rise to the pulsation of the radial artery and causes the sound heard through the stethoscope. As the pressure in the cuff falls still further, flow through the brachial artery persists for progressively longer portions of each heart cycle and finally, when the cuff pressure falls below the diastolic arterial pressure the blood flow in the brachial artery is continuous. When this occurs the sounds heard over the brachial artery suddenly become weaker and shortly disappear. The cuff pressure at the moment of the appearance of the first phase indicates systolic pressure. The general tendency at the present time is to take the cuff pressure at the beginning of the fourth phase, — that is, at the moment of sudden muffling of the sounds as the diastolic pressure.[1] Usually the complete disappearance of the sounds occurs at a pressure not more than 5 millimeters of mercury lower.

PHYSICAL FACTORS AFFECTING THE AORTIC BLOOD PRESSURE.

A. Cardiac stroke volume. (see Figure 2, A and B). The amount of blood pumped out by the heart per beat, i.e., the cardiac stroke volume, is determined in part by the contractile power of the heart muscle, but even more importantly by the amount of

[1] See standardization of blood pressure determinations. Am. Heart Jour., 18: 95, 1939, and Jour. Am. Med. Assoc., 113: 294, 1939.

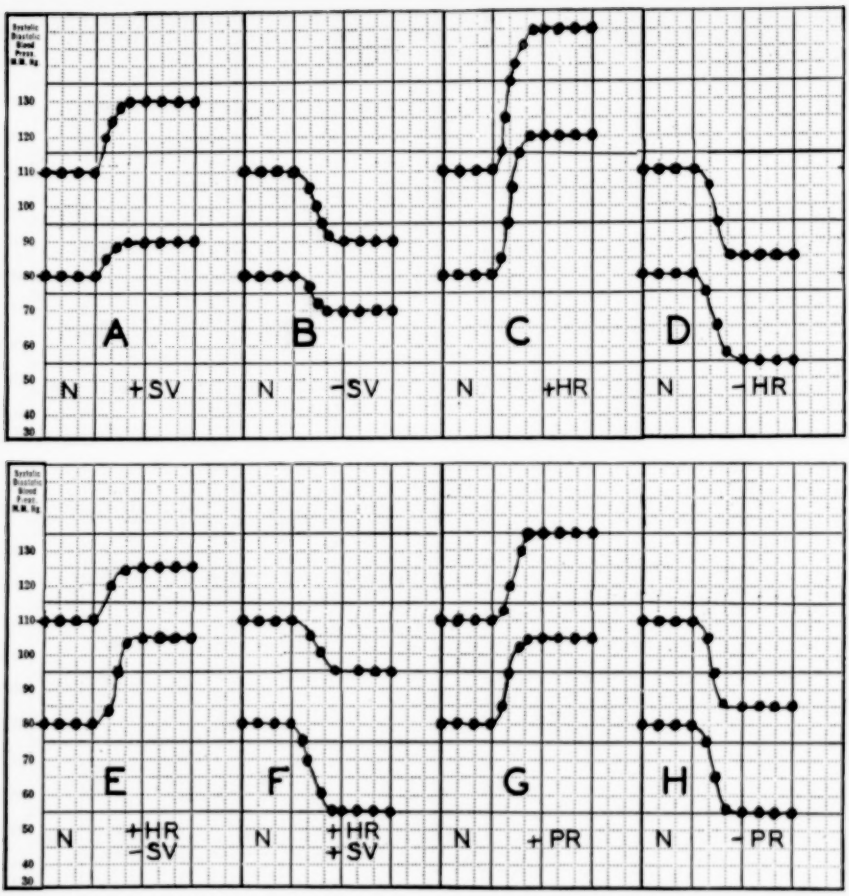


Figure 2. Effects of the three primary variables: volume of blood ejected by the heart per beat—stroke volume (SV), heart rate (HR) and peripheral resistance (PR) upon blood pressure.

A — stroke volume and cardiac output (SV x HR) increased. **B** — stroke volume and cardiac output decreased. In **A** and **B** heart rate and peripheral resistance remain constant. **C** — heart rate and cardiac output increased. **D** — heart rate and cardiac output decreased. In **C** and **D** stroke volume and peripheral resistance remain constant. **E** — heart rate and cardiac output increased with slight decrease of stroke volume, peripheral resistance remaining constant. **F** — heart rate and cardiac output decreased with slight increase of stroke volume, peripheral resistance remaining constant. **G** — increased peripheral resistance. **H** — decreased peripheral resistance. In **G** and **H** heart rate, stroke volume and cardiac output remain constant.

● = systolic and diastolic arterial pressure.

blood returning to the heart by way of the veins. This latter factor determines the extent to which the heart is filled during diastole and this directly conditions the effort which the heart will expend in contracting. In-

creased venous return, by stretching the ventricle, will cause in turn a larger volume of ejection per beat, i.e., will increase the stroke volume of the heart, and conversely, decreased venous return will decrease the stroke volume. If there is no change of heart rate then the increased stroke volume, occasioned by the increased venous return, will not only result in a widening of the pulse pressure but also in an increase in the volume of blood pumped into the aorta per minute. (The volume of blood pumped out by the heart per minute is frequently called the cardiac output.) Since the inflow is then greater than the outflow, there will result a gradual accumulation of blood in the aorta which will cause a gradual rise of the mean arterial pressure. With this rise of mean pressure the rate of outflow through the capillaries will increase progressively until the rate of flow of blood out of the aorta equals inflow, when the arterial pressure will become stabilized at a higher level. An example of increased cardiac output associated with an augmented stroke volume is the wider pulse pressure and elevation of mean arterial pressure seen in exercise. Conversely, if the venous return to the heart and therefore the volume of blood ejected from the heart per beat is decreased, the outflow from the aorta will temporarily exceed the inflow and the distension of the aorta and therefore the arterial pressure will gradually decline until outflow equals inflow and a new equilibrium is again established at a lower level of arterial mean pressure. This is a situation which may be seen in cases of surgical shock when mean arterial pressure and pulse pressure are both decreased.

would be little change in pulse pres-

B. Heart rate. If the heart rate and the rate of return of blood to the heart by the veins were equally increased so that the amount of blood ejected per beat remained constant then there sure, since the distension of the aorta during each systole would be the same. However, the total amount of blood entering the aorta per minute would be increased. This would result in a gradual accumulation of blood in the aorta and in a gradual increase of the mean arterial pressure. With this latter effect, however, there would be, as noted above, a progressively increasing rate of outflow through the capillaries. Eventually this outflow per minute would equal the increased rate of inflow and the mean pressure would become stabilized at a new higher level. With slowing of the heart rate the opposite would occur. (See Figure 2, C and D). With marked increase of heart rate, however, there might be some decrease of pulse pressure, since with speeding of the heart and shortening of diastole relative to systole there would be a somewhat greater systolic outflow from the aorta.

In shock and similar conditions the heart rate may be increased reflexly more than the return of blood to the heart. As a result, while the volume of blood pumped out per minute may be increased, the stroke volume will decrease. As shown in Figure 2, E and F, the mean pressure may then be elevated, but because of the decreased stroke volume the pulse pressure will decrease.

C. Peripheral resistance. Besides heart rate and cardiac stroke volume one other factor can affect the mean arterial pressure, namely, the resistance to flow of blood out of the aorta. If the arterioles controlling the rate of flow of blood into the capillaries become more widely opened or if additional previously closed arterioles open up, blood will flow more rapidly out of the aorta. If the cardiac output does not change, blood will flow out of the aorta faster than it is entering it and the distension of the aorta and therefore the mean pressure will decline. As a result of this progressive

decline of arterial pressure, however, there will be a decrease in the rate of flow through the capillaries until the rate of outflow of blood from the aorta becomes equal to the rate of inflow, at which time tte distension of the aorta and mean arterial pressure again become stabilized. (See Figure 2, H). This phenomena of decreased peripheral resistance is often observed in spinal anesthesia, and probably occurs in the late stages of shock and low blood pressure following hemorrhage. The contrary may also be observed. Constriction of many of the arterioles may occur, resulting in temporarily decreased outflow from the aorta relative to inflow and therefore in accumulation of blood and in distension of the aorta and elevation of mean arterial pressure. (See Figure 2, G). This is the phenomena occuring in high blood pressure, or hypertension, as it is frequently called. With a constant heart rate and stroke volume there will be little change in pulse pressure, unless the mean blood presure changes rather markedly.

D. Aortic elasticity. With a normally elastic aorta neither moderate elevation nor depression of arterial mean pressure will have much effect on the pulse pressure if the stroke volume of the heart remains constant, since the aorta exerts approximately the same amount of elastic recoil for a given addition of blood to it, regardless of the existing mean pressure. With increasing age, however, and especially in individuals with arterial sclerosis and also in many of those with severe hypertension the aorta tends to become more rigid. As a result, even with a normal cardiac stroke volume the arterial pressure rises higher during systolic ejection and has a greater decline during diastole than would normally be the case. As a consequence, in such individuals the pulse pressure is greater than normal.

PHYSIOLOGICAL MECHANISMS FOR MAINTAINING THE BLOOD PRESSURE CONSTANT. In each individual the arterial pressure varies only a few millimeters of mercury from an average level which will assure in that person an adequate distribution of blood to all parts of the body, including most importantly the head when in the vertical position. In most individuals this level is between 100 and 130 millimeters of mercury for the systolic pressure and 60 to 90 millimeters of mercury for the diastolic pressure. While these are different in each individual and while they gradually increase with age they remain in a given person remarkably constant over long periods of time when the subject is in basal conditions, and even during such stresses as eating, exercise, anesthesia, surgical operations and the like.

When at rest it is likely that the factors affecting blood pressure, namely, heart rate, stroke volume and constriction of the arterioles will remain reasonably constant but, with the above noted stresses, demands are put on the body which tend to alter these considerably. For example, digestion or exercise causes increased demand for blood in the active parts, which results in dilating the arterioles in these tissues and therefore in allowing blood to run out of the aorta faster than normally. Another example is the effect of surgical operations or hemorrhage which may cause a decreased return of blood to the heart and therefore decreased cardiac stroke volume. Either of these would tend to lower arterial pressure.

In order to prevent or minimize such changes of arterial pressure and the accompanying fluctuations of blood supply to such vital organs as the brain, heart and kidney, the body brings into action certain compensatory reflexes. The sensory endings of these reflexes are located mainly in the walls of the aortic arch and in the walls of the carotid arteries at their bifurca-

tions. These endings transmit their impulses to the integrating centers, located chiefly in the medulla, and thence to the heart, chiefly by way of the vagus, and to the arterioles throughout the body, chiefly by way of sympathetic nerve fibers in the spinal nerves. Normally both of these pathways are constantly active. Impulses over the former are constantly tending to slow the heart and those over the latter are constantly tending to maintain a certain degree of constriction of the arterioles. When anything tends to lower the arterial pressure, these reflexes operate to decrease the activity of the vagus nerve, thus increasing the heart rate, and to increase the activity of the vasoconstrictor nerves to the arterioles, both of which factors as will be noted above tend to increase the quantity of blood in the aorta and thereby prevent a fall of arterial pressure. The speeding of the heart and the pallor of the skin during the initial stages of hemorrhage are examples of these reflexes. Conversely, if anything tends to elevate arterial pressure above the normal level, these reflexes will operate to slow the heart and dilate the arterioles, i.e., to decrease the peripheral resistance. Such a response would occur, for instance, if an intravenous transfusion were given too rapidly, since this would itself tend, by increasing the venous return to the heart, to augment the cardiac stroke volume and thereby elevate arterial pressure. If the disturbance in the circulation is too great, then despite these reflexes, change of arterial pressure may occur.

DISTURBANCES OF BLOOD PRESSURE WHICH MAY OCCUR IN THE OPERATING ROOM. A brief review of some of the disturbing factors that may be met in the operating room, and the reactions of the body to them, are given in the following paragraphs.

A. Spinal anesthesia. After administration of a spinal anesthetic there may be a fall of mean arterial pressure and narrowing of the pulse pressure, associated with nausea, faintness and air hunger. The changes in arterial pressure are considered to be due in part to a dilatation of the arterioles and resulting decreased peripheral resistance in the abdominal viscera and lower parts of the body, and also in part to loss of muscular tone, resulting in a decreased return of blood to the heart. These effects are brought about by blocking of the spinal nerves by the anesthetic. Due to fall of blood pressure the heart is reflexly speeded. By placing the patient in the prone position, or better yet, with the head down, the return of blood from the lower parts of the body is improved, thus improving the circulation to the brain and aiding in the relief of some of the symptoms.

B. Asphyxia. The response of the circulation to asphyxia cannot be readily generalized, since it depends upon such factors as whether the asphyxia is associated with retention or elimination of carbon dioxide in the body, the suddenness of onset and the type of anesthesia. However, the changes which occur are those which would cause an increased rate of flow of the inadequately oxygenated blood through the vital organs, such as the brain and heart. Thus, during the early stages of asphyxia there is usually some elevation of arterial pressure, increase in the pulse pressure and augmentation of the rate and depth of respiration. The heart rate may be either increased or decreased. The rise of blood pressure may be due in part to a constriction of the arterioles in many parts of the body, but in view of the widened pulse pressure it seems probable that there is also an increase in the amount of blood pumped out per beat and per minute. The arteriolar constriction and any increased heart

rate observed are caused by reflexes initiated by stimulation of neurones located in the carotid sinus and in the medulla which respond to elevation of the carbon dioxide or lowering of the oxygen tension of the blood. The reflex arcs mediating this effect are essentially similar to those serving to maintain a constant arterial pressure which was described above. Slowing of the heart, if observed, is due in part to the operation of the aortic and carotid artery pressure reflexes, whereby an elevation of arterial pressure is countered by reflex discharge of impulses over the vagus nerve tending to slow the heart and thereby to prevent an excessive rise of arterial pressure. With further asphyxia there may be failure of respiratory action, decline of mean arterial pressure as the heart and vasomotor reflexes fail and cardiac output falls, and finally death due to combined failure of the circulation and respiration. If artificial respiration is given within a few seconds after failure of respiration recovery may occur, but if delayed beyond two to five minutes irreparable damage is done.

C. Hemorrhage. With slow progressive hemorrhage there results a decrease of venous return of blood to the heart and therefore in cardiac output. The fall of arterial pressure that would be produced by this is at first prevented by speeding of the heart and by constriction of the arterioles, particularly in the skin and viscera. The return of blood to the heart is probably aided by constriction of the veins. If the hemorrhage is stopped the blood volume will be at least partially restored within a few hours by absorption of fluid into the blood from the tissue spaces. As a result of these compensatory mechanisms in the early stages of a progressive hemorrhage, only narrowing of the pulse pressure and speeding of the heart with little fall of mean arterial pressure are observed. If the hemorrhage continues, a point is reached where further compensatory action is impossible. When this occurs the patient enters a shock-like state, arterial pressure falls rapidly, respiration fails and cardiac action becomes weak, further impairing the circulatory mechanisms and leading rapidly to death. If the hemorrhage is stopped and especially if transfusions of blood, serum or plasma are given before the mean blood pressure has dropped below 50 millimeters of mercury, recovery usually occurs, but if the mean pressure falls much below 50 millimeters of mercury and especially if it remains at this level or lower for a half hour or longer, such severe damage is apparently done to the cardiovascular and nervous machinery by the prolonged ischemia that it is difficult to bring about recovery even with large and repeated transfusions.

D. Shock has been defined as a state of peripheral circulatory failure characterized by low arterial blood pressure, narrow pulse pressure, rapid heart rate and rapid respiration. The fundamental disturbance is a reduction in the effective volume of circulating blood and therefore a decrease in the return of blood to the heart and in the cardiac output. This is analagous to the situation occurring in cases of severe hemorrhage, and accounts for the essential similarity of the changes in arterial pressure which are observed.

Various theories have been proposed to account for the reduction of the circulating blood volume, but despite extensive research little is known with certainty. In the case of extensive burns at least some of the loss of fluid is through seepage of serum onto the burned surface. In crushing wounds there may be considerable loss of blood through ruptured vessels and loss of plasma through damaged capillary walls. However, following experimental manipulation or exposure of

the intestines, and following infliction of painful injuries, shock may occur without obvious large scale trauma. In these and also in the above examples it is felt that there is widespread damage to capillaries, allowing either loss of the plasma of the blood by diffusion into the tissues or dilation of the capillaries with pooling of the blood. In either case the net result is a reduction in the amount of blood returning to the heart, a decreased stroke volume and a tendency for the arterial pressure to fall, the pulse pressure to narrow and the heart to be reflexly speeded.

Prior to any fall of arterial pressure a sort of prodromal stage of shock may be present in which decreased circulating volume and decreased cardiac output are already present, but in which a fall of arterial pressure is prevented by reflex constriction of the arterioles and veins described as occurring as a result of hemorrhage. When the cardiac output is reduced to such an extent that these compensatory mechanisms are no longer able to maintain the arterial pressure, it falls to the low level characteristic of shock. This low pressure and resulting ischemia of the capillaries leads to still further damage to them, thus completing a vicious cycle.

Transfusion of considerable amounts of blood, serum or plasma are usually of considerable value if given early. As with hemorrhage, however, if they are delayed so that the patient's mean arterial pressure remains very long at levels around 50 millimeters of mercury, it is extremely difficult to bring about recovery.

With both hemorrhage and shock there is during the early compensated stage acceleration of respiration, pallor, faintness and a sense of impending disaster. With the rapid decline of aortic pressure there results unconsciousness, loss of reflexes, failure of respiration and death. Unlike hemorrhage, restoration of the circulating blood volume by absorption of fluid from tissue spaces is probably not readily accomplished in shock, due to the impaired capillary function.

E. Increased intracranial pressure. As a result of a skull fracture with rupture of one of the meningeal arteries, intracranial pressure usually increases. In order to maintain a circulation through the brain the arterial pressure rises so as to remain always above the intracranial pressure. Due in part to the cardiovascular reflexes described above, the heart may slow and the pulse pressure may be increased. However, eventually a point is reached where further rise of arterial pressure is not possible. As a result, first the respiratory center fails, putting a further load upon the circulation, and then the nervous centers controlling the arterioles and heart fail, blood pressure falls, the heart speeds, and death occurs.

CLINICAL DISTURBANCES OF THE CIRCULATION. In addition to factors such as the above, which may be met with during the course of an operation, there are numerous clinical conditions which may affect the blood pressure at the time the patient is brought to the operating room. A few are discussed in the following paragraphs.

A. Thyrotoxicosis. Excessive secretion by the thyroid gland results in a higher rate of bodily metabolism, which in turn demands a greater activity of the circulation to supply the augmented tissue demands. This increased circulation expresses itself in a speeded heart rate, augmented stroke volume of the heart and some dilation of the arterioles. These factors are reflected in the wider pulse pressure and slightly elevated mean blood pressure and in the flushed and warm skin.

B. Cardiovascular diseases.

(1) Hypertension. In many cases hypertension is thought to be due to

the formation and release into the blood of an arteriolar constrictor substance by the kidney. As a result of the generalized increase of peripheral resistance produced by this substance the systolic and diastolic arterial pressures are elevated, usually the systolic more than the diastolic, due to a decreased elasticity of the aorta at high arterial pressures, so that the pulse pressure is increased and the heart rate and cardiac stroke volume are usually unchanged.

(2) *Cardiac decompensation.* Patients with cardiac decompensation will be seen rarely and their blood pressure will follow no particular trend but will be dependent upon the original disease which caused their heart to fail. A common cause of heart failure is hypertension; other frequent causes are diseases of the valves of the heart. A set of the valves may become scarred so that they are unable to open to allow free passage of the blood at the proper moment. The scarring may, on the other hand, prevent the valves from closing properly, so that blood regurgitates through the valve in the wrong direction. Examples of the former are aortic or mitral stenosis and an example of the latter is aortic insufficiency. The mean level of the blood pressure is usually normal and the pulse pressure in the first two may be normal or decreased, depending upon the presence of some other concurrent disturbance of the circulation, but the pulse pressure is greatly increased in the last, due to the fact that the regurgitation of blood into the ventricle during diastole plus that normally entering from the veins causes an increased filling of the ventricle and therefore a greatly augmented stroke volume. (3) Auricular fibrillation, which causes a grossly irregular rhythm in the ventricle, may be associated with no change or with a narrowing of the pulse and irregularity of the arterial pressure, depending upon the heart rate and the degree of irregularity of cardiac rhythm.

REFERENCES

Anrep, G. V. Studies in Cardiovascular Regulation. Lane Lect. Stanford Univ. Press, 1936.

Bazett, H. C. The Circulation (In Macleod's Physiology in Modern Medicine). Edited by Philip Bard, The C. V. Mosby Company, St. Louis. 9th Ed., 1941, chapters 32 and 37.

Blalock, A. Principles of Surgical Care. (Shock). The C. V. Mosby Co., St. Louis, 1940.

Goldblatt, H. Experimental Hypertension Induced by Renal Ischemia. Harvey Lect. 1937-8, pg. 237.

Hallock, P., and Benson, I. C. Studies of the Elastic Properties of Human Isolated Aorta. J. Clin. Inv. 16: 595, 1937.

Harrison, T. R. The Pathogenesis of Congestive Heart Failure. Medicine, 14: 255, 1935.

Keys, A., and Friedell, H. L. Measurement of the Stroke-volume of the Human Heart from Roentgenograms; Simultaneous Roentgenkymographic and Acetylene Breathing Experiment. Am. J. Physiol. 126: 741, 1939.

Krogh, A. On the Influence of Venous Supply on the Output of the Heart. Skand. Arch. of Physiol. 27: 126, 1912.

MacWilliams, J. A. Blood Pressures in Man under Normal and Pathological Conditions. Physiol. Rev. 5: 303, 1925.

Mann, F. C., and Essex, H. E. The Present Status of the Problem of Traumatic Shock. Am. J. Surg., N.S., 28:160, 1935.

Mathison, G. C. The Effects of Asyphxia upon the Medullary Centers. I. The Vasomotor Center. J. Physiol. 42: 283, 1911.

Moon, V. H. Shock, Its Mechanism and Pathology. Arch. Path. 24: 642, 794, 1937.

Patterson, S. W., Piper, H., and Starling, E. H. The Regulation of the Heart Beat. J. Physiol. 48: 465, 1914.

Schmidt, C. F., and Comroe, J. H. Functions of the Carotid and Aortic Bodies. Physiol. Rev. 20: 115, 1940.

Smith, H. W., Rovenstine, E. A., Goldring, W., Chassis, H., and Ranges, H. A. The Effects of Spinal Anesthesia on the Circulation in Normal Unoperated Man with Reference to the Autonomy of the Arterioles, and Especially that of the Renal Circulation. J. Clin. Inv. 18: 319, 1939.

Starr, I., Jr., Donal, J. S., Margolies, A., Shaw, R., Collins, L. H., and Gamble, C. J. Studies of the Heart and Circulation in Disease; Estimations of Basal Cardiac Output, Metabolism, Heart Size and Blood Pressure in 235 Subjects. J. Clin Inv. 13: 56, 1934.

Symonds, B. The Blood Pressure of Healthy Men and Women. J.A.M.A. 80: 232, 1923.

Wiggers, C. J. Physiology in Health and Disease. Lea & Febiger. Philadelphia, 3rd Ed. 1939, Chapters 27, 34, 39 and 44.

Wiggers, C. J. The Applicability of Experimental Results to the Shock Problem in Man. J.A.M.A. 1941 (to appear)

Wiggers, C. J. Cardiac Adaptations in Acute Progressive Anoxia. An. Int. Med. 14: 1237, 1941.

BOOK REVIEW

CYCLOPROPANE ANESTHESIA By BENJAMIN HOWARD ROBBINS, B.A., M.S., M.D., Associate Professor of Pharmacology, Vanderbilt University School of Medicine. Pages 175. Baltimore: Williams & Wilkins Company, 1940.

Dr. Robbins, with his background in pharmacology and research done on various anesthetic drugs, is in a particularly favorable position to present a well-rounded and balanced picture of the effects of cyclopropane on the organs and tissues of the body. Although in his experimental work animals were used, the author derives his conclusions by comparison with reports published by anesthetists who have studied the clinical effects of this anesthetic. In addition, the author furnishes an unbiased summary of the important intervening literature and an excellent bibliography which includes everything that has been published up to date on this valuable anesthetic agent.

The eleven carefully and fully documented chapters of the book cover admirably and in a comprehensive fashion the pertinent facts about cyclopropane and serve to stimulate interest in the evaluation of the enormous number of informative articles already published. For anyone who wishes an orderly and exhaustive statement as to "where he may go to find such and such," here is the answer. At the end of each chapter a summary is presented which assists the reader materially in evaluating the facts and opinions set forth.

The initial chapter opens with a brief historical consideration of cyclopropane and states that present methods for production of this gas are based upon the original observations of Freund, and then takes up the physical and chemical properties of this anesthetic agent. The solubility of cyclopropane in water, blood, and oils is gone into thoroughly, and several figures and tables which are easily understandable are presented showing methods used and tabulation of results of analysis. Experimental studies show cyclopropane to be two and a half times more soluble in the cells than in the plasma.

Beginning with an exposition of reports made by clinicians in regard to concentrations of cyclopropane required for anesthesia and for respiratory arrest, the second chapter further tabulates concentrations of this anesthetic required to abolish reflexes important in anesthesia signs; effects of premedication upon the concentration necessary to establish anesthesia; time required for equilibrium or saturation to be attained; and rate of elimination of cyclopropane after its administration is discontinued.

Dr. Robbins stated that in dogs anesthetized with cyclopropane the knee jerk was the first reflex to disappear. This is in contrast with the abolition of the knee jerk reflex under ether anesthesia, which disappears at a higher concentration than abdominal rigidity. The corneal reflex disappeared next, at a concentration of 18 per cent cyclopropane. The abdomen was well relaxed with a 22 per cent concentration, and the lid or wink reflex disappeared at 27 per cent, while the intercostal muscles lost activity at 33 per cent, and respiratory arrest was produced at 36 per cent concentration.

The most interesting conclusion that Dr. Robbins draws from his reports in this chapter is that premedication increases the margin of safety of cyclopropane. The author found that the amount of cyclopropane necessary to produce surgical anesthesia in dogs is very markedly reduced following premedication but does not comparably

alter the concentration required for respiratory arrest.

It is brought out that the rate of saturation or de-saturation of an anesthetic gas is dependent on three factors: its solubility in blood, tissue, and fat; the cardiac output; and respiration per minute volume. With cyclopropane, which has a solubility in blood of .45 to .5 as compared to 14 for ether, the cardiac output would play the major rôle in saturation. By testing samples of blood from anesthetized dogs it was found that the concentration of cyclopropane in the mixed venous blood is equal to that in the arterial blood, which is in equilibrium with that in the anesthetic mixture in the alveoli after fifteen minutes on a fixed concentration of cyclopropane. In the light of the above facts the author states that the concentration of cyclopropane in the blood is proportional to that in the alveoli after the dog has been on a fixed concentration for fifteen to thirty minutes, at which time the amount in the mixed venous blood is equal to that in the arterial blood.

The importance of the effects of cyclopropane anesthesia upon the circulatory system is evidenced by the fact that the author devotes some seventy pages to this phase of the subject. In this section are included numerous tables and figures showing the reaction of dogs with and without premedication in the different stages of anesthesia as indicated by the respiration, circulation and reflexes. Records are included which show the reaction of dogs in different stages and planes of anesthesia with decerebration, vagi cut, ligation of carotids and bilateral sympathetic denervation of the heart. The reader can follow these tables and figures easily, as the explanation accompanying each is clear and comprehensive. A further help in interpreting the figures and tables in this chapter is the detailed explanation of the preparation, equipment, materials, methods, and techniques used in each experiment.

By comparison of the figures tabulated (Table 14) as shown on normal dogs carried into fourth stage anesthesia accompanied by respiratory arrest and figures tabulated (Table 14) as shown on dogs with vagi cut, and in the same stage of anesthesia, one concludes that the vagus has very little effect upon the arterial concentration of oxygen, carbon dioxide, and cyclopropane at which respiration ceases and cardiac irregularities are evidenced. The types of irregularities reported as noted both clinically and experimentally include nodal rhythm, nodal extrasystoles, ventricular extrasystoles, auricularventricular block, multiple focus ventricular tachycardia, and auricular flutter. These irregularities change to normal rhythm under artificial ventilation and an increased arterial oxygen content.

The author observed that under artificial respiration the heart remained normal with an arterial concentration of 46.2 milligrams of cyclopropane per 100 cc. of blood, whereas respiration ceased with a cyclopropane content of 31.2 milligrams per 100 cc. of blood. He concludes from the above data that under adequate artificial respiration cyclopropane concentrations can be increased to a level of 30 per cent higher than necessary for respiratory arrest, while the heart remains normal. In studying the relation of premedication to cardiac irregularities in dogs under cyclopropane anesthesia, it was observed that dogs which received morphine preanesthetic developed bradycardia and that nodal rhythm and ventricular extrasystoles were present during the third stage in planes one to four; while in the dogs that received barbital or amytal preanesthesia the rhythm remained normal as long as twenty to forty minutes after respira-

tory arrest produced by cyclopropane.

Results were produced experimentally in dogs after bilateral removal of sympathetic ganglia and trunk, excision of adrenals, and section of vagi that indicate that in the dog premedicated with morphine the changes in the heart rate brought about by cyclopropane anesthesia are due to the action of the agents upon and through the parasympathetic system, and that the action of these agents upon the sympathetic system in relation to the heart is relatively small. Premedication with morphine before cyclopropane gave rise in dogs to the most frequent types of cardiac changes as reported occurring in man.

Records show that under cyclopropane anesthesia the cardiac irregularities and respiratory arrest occurred in the control dogs earlier than in the barbiturate premedicated group. Cardiac irregularities occurred in a larger number of the control dogs than in the barbiturate premedicated dogs. The foregoing evidence would seem to justify the trial of the use of a barbiturate instead of morphine as a premedicant preceding cyclopropane anesthesia. In his all-conclusive discussion of a choice of preanesthetic medication the author points out that cardiac irregularities observed with cyclopropane are of two types: first, a bradycardia with ventricular extrasystoles which are due partly to excessive vagal tone; second, a tachycardia of nodal origin that may be explained as due to an increased irritability of the automatic tissue of the heart. The author has shown experimentally that morphine and cyclopropane combined produced marked bradycardia and irregularities in dogs in surgical anesthesia even in the presence of adequate oxygen, and that amytal prevented development of cardiac irregularities even in the presence of high cyclopropane concentration in the blood and severe anoxemia. Dr. Robbins feels that amytal reduces the excessive vagal tone which is present with morphine and cyclopropane anesthesia and also that the increased irritability of the myocardium and automatic tissues due to cyclopropane and anoxemia is reduced to a level below the irritability of the sinu-auricular node. The author is of the opinion that the amount of atropine or scopolamine given with the usual dose of morphine does not paralyze the vagal endings, but stimulates the vagus center so that there is an actual reduction in the heart rate. Cyclopropane increased the heart rate of dogs in all planes of anesthesia, while on monkeys it served to decrease the heart rate proportionally as the depth of anesthesia increased.

Blood pressure changes in unpremedicated dogs showed an increase which was maintained until respiratory arrest occurred. In dogs receiving morphine the blood pressure showed a fall resulting from the morphine, and a further drop was observed under cyclopropane anesthesia; while in dogs receiving amytal the blood pressure maintained a normal level during anesthesia but showed a slight decrease at respiratory arrest. There is much else of interest in this third chapter, but I shall leave it for the reader to discover.

We pass now from the observations made on the effects of cyclopropane on the circulatory system, to its effects on the respiratory system. Cyclopropane has very little irritant effect, if any, upon the mucosa of the respiratory tract. The author quotes Waters, Schmidt, and Romberger as stating that concentrations up to 50 per cent are without irritant effect, and this leaves the patient without protective reflex against the inhalation of unusually high concentrations of cyclopropane. The effect of cyclopropane upon the rate and amplitude of respiration is negligible. During the deeper planes of sur-

gical anesthesia there is a gradual diminution in the rate and a more rapid reduction in the minute volume. Henderson and Lucas report that the tidal exchange is cut more than half in cats and dogs as the concentration is increased. The author showed that there was little change in the minute volume in dogs anesthetized with cyclopropane as the concentration was increased, but that the tidal volume decreased, whereas the rate increased sufficiently to keep the minute volume near control.

In publications by Shackell and Blumenthal as quoted by the author, there was shown a decrease in the rate of respiration in monkeys under cyclopropane anesthesia, and the decrease was more marked in the deeper planes, as it is in man. Studies of the oxygen content of arterial and venous blood indicate that tissue oxygenation is adequate until the fourth plane of the third stage of anesthesia is reached. The effects of premedication upon the respiration as shown by oxygen content of the blood in dogs seems to be evidence that barbiturates in relatively larger doses than morphine, do not reduce the adequacy of respiration more than morphine.

The author feels that high oxygen tension in the anesthetic mixture is an important factor in determining the rate and amplitude of respiration in animals and man and quotes Shackell and Blumenthal as finding that an average of 70 per cent oxygen in the anesthetic mixture requires a concentration of 25.7 per cent to produce respiratory arrest; whereas when the oxygen content of the anesthetic mixture was about the same as that of air, a concentration of 33.7 per cent of cyclopropane was necessary to produce respiratory arrest. From the foregoing findings he concludes that there is little doubt but that a high concentration of oxygen in the anesthetic mixture is the main factor in the reduction of the amount of cyclopropane necessary to produce respiratory arrest in monkeys. Waters and Schmidt are quoted as reporting similar findings in man. An explanation of this action is offered by Marshall, Rosenfeld, and Schmidt on the basis that a high tension of oxygen further depresses the respiration and produces apnea in animals with respiratory mechanism already depressed by the anesthetic, and that in the depressed animal respiration is maintained by the stimulant action of relative anoxia upon the sino-aortic mechanism (carotid bodies and aortic bodies); and when high concentrations of oxygen are given, this anoxic stimulus is abolished and respiration is further decreased, or apnea develops.

The subject matter dealing with the relation of anesthesia and premedication to asphyxia in the new-born brings to light the startling fact that a mixture of nitrous oxide containing less than 15 per cent oxygen depressed the fetal respiration, even though the mother was not anesthetized, and that only with cyclopropane and oxygen could surgical anesthesia be produced in the mother without depressing or abolishing the fetal respirations. A summarized report on this subject by Drs. Rosenfeld and Snyder is included in this chapter and is herewith quoted as given by the author: "Most anesthetics of both volatile and non-volatile types suppress the intrauterine respiration long before surgical anesthesia is reached in the mother. The result with cyclopropane illustrates the attainment of one important objective in obstetrical anesthesia, namely, the production of full surgical anesthesia of the mother without interruption of fetal respiration."

The author does not give any experimental data of his own regarding the rate of absorption of anesthetic

gases in relation to postoperative atelectasis, but quotes findings as reported by Jones and Burford, Coryloss and Birnbaum, and Lemmer and Rovenstine. The author quotes Jones and Burford as maintaining that such collapses occurred purely on a physical basis due to the rapid rate of absorption of both cyclopropane and oxygen from the alveoli. They further state that at the end of a period of anesthesia with cyclopropane-oxygen, the mixture in the alveoli and in the bag is practically pure cyclopropane and oxygen with only a minimum amount of inert gases, and that during the deeper levels of anesthesia the respiratory volume is decreased so that the distal alveoli are not dilated with each inspiratory effort, consequently there is a rapid absorption of cyclopropane and oxygen and a resultant collapse of the alveoli. They advise the use of some slowly absorbed inert gas in the anesthetic mixture so that the distal alveoli will not collapse during anesthesia or soon after, due to complete absorption of the oxygen and cyclopropane while the respirations are still reduced below normal. The reports made by Coryloss and Birnbaum as a result of their studies on the rate of absorption of the different gaseous agents, vary somewhat from the results reported by Lemmer and Rovenstine and quoted by the author.

Dr. Robbins concludes from the literature relating to postoperative complications of the gastro-intestinal tract following anesthesia, that distention and ileus are encountered less frequently following cyclopropane than ether anesthesia, and this would indicate that cyclopropane has less effect on normal gastro-intestinal tone and activity than ether. Bisgard and Johnson are credited with showing that in both man and dog the tone and contractility of the gastro-intestinal tract were changed less under cyclopropane alone or combined with avertin, than when other anesthetic agents were used.

In view of the fact that the author gives no experimental data of his own relating to the effects of cyclopropane anesthesia on the blood, his conclusions on this subject are drawn from reports of studies made by others. Dr. Robbins states that cyclopropane anesthesia produces no significant change in the pH, carbon dioxide content, or carbon dioxide combining power of the blood. The oxygen content and capacity are increased during anesthesia. The total bases of the serum are unchanged. Inorganic phosphates are increased after cyclopropane anesthesia, but non-protein nitrogen is not increased. The blood sugar rises slightly in normal patients, but there is no change in controlled diabetics. A marked leucocytosis is shown following cyclopropane anesthesia, but the red cells show only insignificant changes.

In attempting to evaluate the findings of various investigators regarding the effects of cyclopropane anesthesia upon tissues other than those already mentioned, the reviewer finds that the reports included show less increase in the secretion of saliva under cyclopropane than ether or chloroform anesthesia; although, Marshall states that cyclopropane stimulates the parasympathetic system because he found an increase of lacrimal and salivary secretion along with contraction of the iris, the gut, and a tachycardia.

The bromsulphalein liver function test made before and after cyclopropane anesthesia showed no liver damage. Both laboratory and clinical data in this book show that cyclopropane anesthesia does not produce liver damage. In studies made upon the effect of cyclopropane anesthesia on kidney function it is indicated that there is no interference with the function as determined by the urea clearance. There is no increase in the nonprotein nitrogen

following cyclopropane anesthesia in man, according to the report of Neff and Stiles.

Some investigators believe that cyclopropane does not decrease uterine contractions in force or frequency, but rather, think it increases uterine contractions. Less post-delivery bleeding occurred in patients who had cyclopropane than those who were given other agents. Though the author reports no experimental studies on the effects of cyclopropane on the ureters and bladder, some investigators believe that there is less functional disturbance of the bladder following cyclopropane than following other agents, as the need for postoperative catheterization was less frequent.

To the clinical administration of cyclopropane the author gives a brief chapter in which he mentions several techniques. The chapter opens with a consideration of the only method used for the satisfactory administration of cyclopropane, and brings out that as early as 1916, the carbon dioxide absorption method of anesthesia was used by Jackson. The mechanism of the two types of carbon dioxide absorbers is adequately described. In his discussion on premedication in this chapter the author points out that neither atropine nor scopolamine in doses generally used for preanesthetic medication produces peripheral paralysis of the vagus to the heart, but on the contrary, may stimulate the vagus and cause a reduced activity of the heart. The suggestion is made in relation to the combined use of morphine and cyclopropane, that carefully controlled electrocardiographic study on clinical patients would determine whether the effects of barbiturates would abolish the cardiac irregularities in man as they do in dogs under morphine and cyclopropane anesthesia, as shown by the author.

The dangers attendant upon the stages and planes of anesthesia under cyclopropane are enumerated, and the author advises a careful and continuous observation of the signs during the entire administration of the anesthetic. The difference in the physical signs under cyclopropane from those under ether are attributed by Waters and Schmidt to the two characteristics of cyclopropane that do not exist with ether. One characteristic is that cyclopropane has practically no irritant effect upon the respiratory tract, which allows the patient to inhale high concentrations without the accompanying laryngospasm that results from the initial inhalation of concentrated ether vapor. The other characteristic is that cyclopropane is not a respiratory stimulant and the rate of respiration is not increased as it is in ether anesthesia, unless carbon dioxide is allowed to accumulate or is administered.

The technique of administration given is general rather than several specifically detailed descriptions, and the reviewer regrets that more space was not given to the various techniques of the clinical administration of cyclopropane.

The author finds that complications during and following cyclopropane anesthesia are no more frequent nor of different types than those found during and following the use of ether. There is reported a case of convulsions and one of acute pulmonary edema during the administration of cyclopropane, as well as numerous cases of heart disturbances, respiratory and circulatory failure with heart behavior symptoms being by far the most frequent. Postoperative massive collapse, partial atelectasis, pneumonia, headache, excitement, nausea and vomiting have all been reported as occurring following the administration of cyclopropane anesthesia.

The indications for cyclopropane anesthesia are so numerous that it would seem more logical to enumerate

the few contraindications, but there are some conditions in which it is of great value and they deserve special consideration. The potency of cyclopropane permits its use with a very high percentage of oxygen and renders it the anesthetic of choice in conditions where high oxygen content is indicated. The author lists these conditions as follows: where excess oxygen is needed due to mechanical causes from obstruction in the respiratory tract and a reduction in alveoli bed, increased oxygen usage necessitated by hyperthyroidism or pregnancy, anemias, cardiovascular risks, or severe operative risks. The use of this anesthetic agent is reported in patients ranging in age from 10 minutes to 98 years.

In view of the fact that cyclopropane-air or cyclopropane-oxygen mixture is explosive over the range used in anesthesia, its use is contraindicated where use of the cautery or other electrical apparatus is anticipated or necessary.

Dr. Robbins advises against the use of cyclopropane where it is necessary to employ epinephrine. He has proved conclusively that cyclopropane anesthesia increases the irritability of the automatic tissue of the heart of dogs, and other investigators by careful experimental studies have shown that the same effect is produced in man. The author has been able to show that the injection of epinephrine in dogs under cyclopropane anesthesia led to the development of severe cardiac irregularities in all dogs, and to ventricular fibrillation in a fair number of dogs. He quotes some investigators as stating that since morphine does not depress the activity of the adrenals, that barbiturates which do depress the activity of the sympathetic system might protect against the development of cardiac fibrillation during cyclopropane anesthesia. Dr. Robbins concludes that both clinical and experimental evidence indicate that epinephrine and certain other sympathomimetic amines should not be used during the administration of cyclopropane.

In his concluding chapter, Dr. Robbins takes up the explosive hazards with cyclopropane, and also includes a summary of anesthetic explosions and fires that have occurred with the use of cyclopropane as well as with the use of other anesthetic agents.

Reference is made to data taken from the report of Jones of the explosive properties of different anesthetic agents, and including the upper and lower limits of inflammability in both air and oxygen mixtures, as well as the minimum ignition temperatures in air and oxygen. This report is found in Table 6 on page 12 and will prove of interest to readers.

The precautionary measures to be used with cyclopropane to reduce the explosive hazards are divided into two groups. The first mentioned is the prohibition of the use in the presence of cyclopropane anesthesia, of electrical apparatus or open flame, x-ray or fluoroscope, high frequency machines, or cautery. Observation is made that since relatively few explosions with cyclopropane have been attributed to the use of electrical apparatus in the operating room, that due care has been used regarding these hazards. The second recommended precaution to be observed is the prevention of electrostatic charge and spark. Reports of explosions with cyclopropane anesthesia show this latter hazard to be the greater offender of the two. The recommendation of the prevention of electrostatic charge, spark, and explosion is a far simpler procedure than the execution of the task. The presence of a high relative humidity in the operating room is of value but assuredly not a prevention of the electrostatic explosion.

The summary on explosions which

Dr. Robbins includes in this chapter was taken from a report published by The Committee on Fires and Explosions of the American Society of Anesthetists. It is a highly interesting and comprehensive report of one hundred seventy cases of fires or explosions under different anesthetic agents. In commenting on the summary the author first points out that out of ninety-nine accidents which could have been avoided by careful application of present information only five occurred during the administration of cyclopropane, and he then calls attention to the fact that out of sixty-six accidents due to electrostatic spark, cyclopropane was used in fourteen cases. In addition he finds that the percentage of fatalities in the explosions with cyclopropane is higher than with the other agents. The fatalities were due mostly to rupture of the lungs and he states that this may be due to one of two or a combination of two factors: first, that a mixture of cyclopropane and oxygen explodes with greater force than other agents; or, second, that with a closed system the pressure built up in the anesthetic-respiratory system is greater than when the open technique is used.

Perhaps both the reader and the author will forgive the reviewer for outlining the book so extensively. There seemed no other way to make it clear that this volume is in no sense to be compared to the usual presentation of the subject. This book is a scientific treatise on a subject that heretofore has not been investigated so thoroughly from as many angles. Many of the findings were wholly unexpected and some are still inexplicable. The report is classical for the appropriateness of its instrumentation and specificity of phenomena studied, for the wealth of new and unanticipated findings, and for the practical and theoretical consequences that will surely follow from further study and investigation.

Rosalie Chase McDonald

Emory University Hospital,
Emory University, Georgia.

HEADQUARTERS

American Association of Nurse Anesthetists

18 East Division Street

Chicago, Illinois

Miss Anna Willenborg, Executive Secretary

CONTEST FOR STUDENTS—SCHOOLS OF ANESTHESIA

As announced in the November, 1940, and February, 1941, issues of the Bulletin, Miss Agatha Hodgins has donated a first prize of $35 and a second prize of $15, for papers on anesthesiology—subject to be chosen by the contestant, and paper not to exceed 1000 words.

This contest is open to students of Schools of Anesthesia whose dates of graduation fall between October 1, 1940, and June 1, 1941, inclusive. Papers must be submitted not later than June 1, 1941. The rules to be observed in the preparation of papers are as follows:

1. Material to be typed on one side of paper only, double space, with margin of at least one and a half inches on each side, top and bottom. Carbon copy should be retained for reference.

2. Pages should be numbered consecutively.

3. Photographs (on glossy paper), tables, drawings, graphs, et cetera, should be on separate sheets, numbered lightly in pencil on back, with title of paper, indication as to top and bottom, and the position in the text indicated by number.

4. Paper, including photographs and other illustrations, should be mailed in flat envelope, protected by sheets of heavy cardboard.

5. Material taken from other authors should be quoted exactly, and indicated by quotation marks, with full reference given, and permission obtained from the writer and the publisher if any considerable passage of a copyrighted work is used.

6. *References and Bibliography.* References to the literature and comments on various matters mentioned in an article that are to be used as footnotes should be numbered consecutively through the article, with corresponding superior reference figures in the text. Although in a printed article foot-notes appear at the bottom of the page on which they are mentioned in the text, we would prefer in the preparation of the manuscript that they be typed in double space on a separate page following the text matter.

If the author has made an exhaustive review of the literature on the subject the references should be grouped in a bibliography at the end of the paper, arranged alphabetically by authors.

Both reference list and bibliography should give name and initials of author, title of the article, name of periodical and date of publication, or book in which it appeared, publisher and year of publication.

7. Papers to be sent to Miss Anna Willenborg, Executive Secretary, American Association of Nurse Anesthetists, 18 East Division Street, Chicago, Illinois, with separate letter giving full name, address, and School of Anesthesia.

No name or address to appear on manuscript. When received, each paper will be given a number, and the Educational Committee of the American Association will pass upon the papers with no knowledge as to the identity of the writer or the School of Anesthesia from which she was graduated.

THE TRUST FUND

The establishment of a "Trust Fund" was suggested at a meeting of the Board of Trustees of the American Association of Nurse Anesthetists on September 28, 1936. The Board, at that time composed of the following members: Gertrude L. Fife, Agatha C. Hodgins, Helen Lamb, Ruth Nash, Verna M. Rice and Anna Willenborg, voted unanimously its approval, and Verna Rice, to whose foresight the Association is indebted for the original idea, was appointed to prepare, with the assistance of an attorney and a trust officer of a national bank, a resolution to be submitted to the Board at the annual meeting in 1937.

The important task of developing a suitable document called for much time and careful study in order to shape into an acceptable form, embodying security of purpose and latitude of service, a plan which would prove to be a definite asset to the membership.

The Trust Fund Resolution as adopted by the membership at the annual meeting held in Atlantic City, N. J., September 14-17, 1937, included the following provisions:

1—*Financing*

(a) Beginning on January 1, 1938, and annually thereafter, there shall be set aside from the Treasury of the American Association of Nurse Anesthetists the sum of ten cents (10c) for each member in good standing, said money to be deposited in a separate account known as the "Trust Fund of the American Association of Nurse Anesthetists" in a bank in which the American Associtaion of Nurse Anesthetists deposits other funds.

(b) Beginning with January, 1943, each State Association affiliated with the American Association of Nurse Anesthetists shall contribute to this Trust Fund the sum of ten cents (10c) per year for each member in good standing.

(c) A form for use in making gifts or bequests may be found in the Bulletin of the American Association of Nurse Anesthetists, or may be obtained, upon request, from Miss Anna Willenborg, Executive Secretary, American Association of Nurse Anesthetists, 18 East Division Street, Chicago, Illinois.

2—*Management of the Fund*

The members of the Board of Trustees of the American Association of Nurse Anesthetists are the Trustees of the Trust Fund.

3—*Security or Protection of the Fund*

Investments of monies are to be made in securities which constitute legal investments for life insurance companies and savings banks under the laws of the State of New York. The said funds are to be invested in no other securities under any circumstances.

4—*Purpose of the Fund*

The purpose for which the Trust Fund was created is to provide for members of this Association who may become indigent through age or permanent physical disability.

5—*Eligibility of Beneficiary*

No person shall be entitled to the benefits of this Fund unless she shall have been an active member in good standing of the American Association of Nurse Anesthetists for not less than twenty (20) years.

NOTE: A copy of the Trust Fund Document may be obtained from Headquarters upon request.

NINTH ANNUAL MEETING

AMERICAN ASSOCIATION OF NURSE ANESTHETISTS

ATLANTIC CITY, N. J.

HOTEL HEADQUARTERS - - RITZ-CARLTON

September 15-19, 1941

For the past two decades Atlantic City has been the nation's most popular convention city—because it provides the most perfect combination of accessibility, natural charm and attractions (the bathing beach is the finest in the world), and excellent convention facilities. It is within an overnight train trip from an area in which lives one-fourth the population of the United States. A trip to Atlantic City has long been synonymous with the ideal vacation or outing—a combination of ocean-borne air and sunshine, with stimulating dips in the surf; relaxation induced by the limitless panorama of sea and sky and an endless variety of diversions.

The Ritz-Carlton, hotel headquarters of the American Association of Nurse Anesthetists during the meeting, is located directly on the Boardwalk, three short blocks from the Municipal Auditorium — the world's largest convention hall, and only five minutes from the Union Station and the Airport.

Each of the 450 guest rooms and suites has private bath with either fresh or sea water, and an unobstructed ocean view.

Rates $3 per day and up. *Make Reservations Early.*

Program Committee

Mrs. Helen Young Walker, Chairman
1824 Wallace Street, Philadelphia, Pa.
Mary A. Patterson, Cooper Hospital, Camden, N. J.
Edwina M. Irons, Episcopal Hospital, Philadelphia, Pa.
Magdalen Suter, Girard College Infirmary, Philadelphia, Pa.
Faye L. Fulton, Methodist Episcopal Hospital, Philadelphia, Pa.

Local Arrangements Committee

Mrs. Marion R. Briggs, Chairman
309 Mattison Avenue, Ambler, Pa.
Mrs. Della Logan Mifflin, Cooper Hospital, Camden, N. J.
Rose L. Furlong, Jewish Hospital, Philadelphia, Pa.
Orpha V. Foster, West Jersey Homeopathic Hospital, Camden, N. J.
Katherine Gagliardi, Lankenau Hospital, Philadelphia, Pa.

MAKE HOTEL RESERVATIONS EARLY.

Program and further particulars will be published in the August issue.

For information write Miss Anna Willenborg, Executive Secretary, American Association of Nurse Anesthetists, 18 East Division Street, Chicago, Illinois.

ACTIVITIES OF STATE ORGANIZATIONS

MID-SOUTH CONVENTION

The seventh annual convention of the Mid-South Post Graduate Nurse Anesthetists Assembly was held in conjunction with the Mid-South Post Graduate Medical Assembly on February 12 and 13, 1941, in Memphis, Tennessee. The meeting was well attended by an interested and enthusiastic group and a large number of instructive papers were presented by outstanding speakers. The program in full was published in the February, 1941, issue of the Bulletin, and some of the papers read appear on pages 73, 80, 91, 94 and 106 of this issue.

Officers Elected:

President	Irene Mason c/o Drs. Hirsch and Beck, Greenville, Miss.
Vice-President	Cordelia H. Hallett Gamble Bros. Clinic, Greenville, Miss.
Vice-President	Inez R. Rausch University of Arkansas School of Medicine and Hospital, Little Rock, Ark.
Vice-President	Nettie M. Bryant 1634 Euclid Ave., Memphis, Tenn.
Secretary	Alberta Kime Sullivan 48 South Diana St., Memphis, Tenn.

CALIFORNIA

The third annual meeting of the California Association of Nurse Anesthetists was held at the Fairmont Hotel, San Francisco, on March 4 and 5, 1941, in conjunction with the Association of Western Hospitals. Program in full was published in the February issue of the Bulletin. The attendance was excellent at each session.

Officers Elected:

President	Mabel P. Cauthorn 318 Elm St., San Mateo
First Vice-President	Gladys M. Bolton 972 Bush St., San Francisco
Second Vice-President	Katherine H. Graham San Francisco Hospital, San Francisco
Secretary-Treasurer	Nan Snodgrass 829 Leavenworth St., San Francisco
Trustees	Above officers, together with: 1 year Mary J. R. Stevenson 2 years Olga E. Schreiber 3 years Martha Bichel
Committees:	
Membership	Mell J. Hanson Kathryn Bartron Irene Doran
Revisions	Edith H. Jones Emmeline Andersen Flora A. Grimes

KANSAS ORGANIZED

The organization meeting of the Kansas anesthetists was held at the Wesley Hospital Huston Nurses' Home, Wichita, Kansas, October 16, 1940. Viola H. Baker, of Wesley Hospital, who called the meeting, presided, and Mildred I. Clark, Station Hospital, Fort Leavenworth, was appointed secretary pro tem.

A constitution and by-laws was read and adopted, and the offer of Zella Hammann, McPherson County Hospital, McPherson, to take charge, without remuneration, of the printing of a copy for each member, was accepted. It was voted unanimously to apply for affiliation with the American Association of Nurse Anesthetists, and the affiliation has since been completed. It was also voted to charge a registration fee of $1.00 to take care of postage and stationery.

The Association will meet twice annually, the fall meeting to be held following the annual convention of the American Association of Nurse Anesthetists.

Upon invitation from Mr. J. E. Lander, President of the Kansas Hospital Association, the spring meetings will be held in conjunction with the hospital group, and with the Mid-West Anesthetists' Assembly. The first of such meetings will be held in Kansas City, Missouri, on April 23, 1941.

Following the business meeting, Mr. Lander gave an inspiring talk on the necessity of organization, and pledged the support of the Kansas Hospital Association. A lecture and demonstration were given of the iron lung recently installed at Wesley Hospital, and an inspection tour of the various departments of the institution was conducted.

The anesthesia staff at Wesley Hospital were hostesses at a social hour and dinner in the nurses' home. The living room, where musical selections were rendered by members of the training school, was artistically decorated. Miss Irma Law, Superintendent of Nurses, well known as a leader in the nursing profession, presented her greetings, and the dinner marked the end of an enthusiastic and enjoyable afternoon.

VIOLA H. BAKER
President

Officers Elected:

President
Viola H. Baker
Wesley Hospital, Wichita

First Vice-President
Velma V. Thompson
Randell Hospital, Marysville

Second Vice-President
Ethel S. Paul
Wesley Hospital, Wichita

Secretary-Treasurer
Mildred I. Clark, A.N.C.
Station Hospital, Fort Leavenworth

Board of Trustees
Viola H. Baker
Velma V. Thompson
Ella Risser
Zella Hammann
Senia I. Mikkola
Ethel S. Paul
Wanda West

Mildred I. Clark left Kansas shortly after her election as Secretary-Treasurer, and Zella Hammann, McPherson County Hospital, McPherson, Kansas, was appointed to succeed her.

MINNESOTA

A meeting was held at the Swedish Hospital, Minneapolis, on November 26, 1940, followed by a luncheon served by the anesthetists at that hospital. Twenty-three were present.

On January 23, 1941, the group met at the Fourth District Club Rooms in St. Paul, Mrs. Marie Petrowske, of Ancker Hospital, St. Paul, acting as hostess. Following the business session, Dr. L. H. Wright of the Squibb

Company, New York, gave a talk on "Hazards of Anesthesia," which called forth an active discussion.

The anesthesia staff at Fairview Hospital, Minneapolis, acted as hostesses at a well attended meeting on February 28, and plans for the annual meeting on May 23 were discussed. A film on intravenous anesthesia was presented by Dr. Hastings of the Abbott Laboratories, following which a lunch was served.

As a result of the card party held on February 13 at Minneapolis General Hospital, Minneapolis, thirty dollars was added to the treasury. Miss Ruth Walthers of Minneapolis General Hospital was in charge and her good work was greatly appreciated. Sixty members and guests were present, and fifteen prizes which had been donated were distributed to fortunate ones during the evening.

The annual meeting of the Minnesota Association of Nurse Anesthetists will be held in the Lowry Hotel, St. Paul, on Friday, May 23, 1941, in conjunction with the Minnesota Hospital Association. There will be a joint session of all the allied organizations in the morning, at which Dr. James Musselman, of the University of Minnesota, will speak on anesthesia.

The annual business meeting and election of officers is scheduled for 2:00 P. M. The following will appear on the afternoon program: Miss Anna Willenborg, Executive Secretary of the American Association of Nurse Anesthetists, Chicago; Mr. D. G. McCurdy of Chicago; and Dr. Thomas Sheldon of Rochester. Members and guests of all hospital groups are invited to attend the banquet on Friday evening.

For further information write Miss Marvel Shurr, Secretary, Midway Hospital, St. Paul, Minnesota.

MICHIGAN

The meeting held on February 22 at St. Mary's Hospital, Detroit, drew an attendance of sixty in spite of the inclement weather. All sections of the state were well represented, and Marion Weigand of Traverse City traveled by plane in order not to miss the meeting.

Mable Courtney, President of the Michigan Association, presided at the afternoon meeting. In December a questionnaire had been sent to sixty hospitals in Michigan employing nurse anesthetists, and the following information was tabulated from the forty-one which were returned, and reported at the meeting by Esther Meil, of Henry Ford Hospital, Detroit:

ANESTHETICS USED IN 41 HOSPITALS IN MICHIGAN

	Percentage of Hospitals in Which Used
Nitrous oxide-ether	100%
Spinal	90%
Sodium pentothal, intravenous	70%
Cyclopropane	66%
Avertin	44%
Ethylene	24%
Sodium evipal	Very few

	No. of Cases	*Percentage*
Nitrous oxide-oxygen-ether	29,948	29%
Nitrous oxide	13,677	13%
Ether-oxygen	879	1%
Ether-drop	29,135	28%
Cyclopropane-oxygen-ether	9,228	9%
Ethylene-oxygen-ether	3,164	2%
Chloroform	266	.2%
Sodium pentothal and evipal, intravenous	3,854	4%
Spinal	14,148	14%
TOTAL	104,301	

Cyclopropane was unsupplemented in 70 per cent of the times used.
Ethylene was unsupplemented in 49 per cent of the times used.
Nitrous oxide was unsupplemented in 32.5 per cent of the times used.

The following anesthetists outlined briefly at this session the method they used for the administration of cyclopropane:

Ada Snider	Grace Hospital, Detroit
Marion Weigand	Traverse City
Loretta Barron	Leila Y. Post Hospital, Battle Creek
Ruth Read	University of Michigan Hospital, Ann Arbor
Kay Sheehan	St. Joseph's Hospital, Pontiac
Evelyn Burford	St. Mary's Hospital, Detroit

At the evening session Miriam G. Shupp, of Strong Memorial Hospital, Rochester, N. Y., Past President of the American Association of Nurse Anesthetists, was the guest speaker, her topic being "The Progress of the Nurse Anesthetists" (published in this issue on page 100). E. Louise Ilgenfritz read a paper on spinal anesthesia administered in 2500 cases at St. Joseph's Mercy Hospital, Detroit, with no fatalities, a modified Leahy technique being used. An active discussion followed the talks, and refreshments were served by the staff at St. Mary's Hospital.

MISSISSIPPI

A meeting of the Mississippi Association of Nurse Anesthetists was held on January 30, 1941, at the Robert E. Lee Hotel, Jackson, Mississippi. Mrs. Elizabeth Wates of Jackson gave an interesting report of the last annual meeting of the American Association of Nurse Anesthetists.

Plans were made to continue the effort to enlist all Mississippi anesthetists in the Association during 1941. Miss Sue Collins of Biloxi was appointed to serve with Mrs. Lydia Yancey on the Educational program for the Southeastern convention.

NEW JERSEY

The annual meeting of the New Jersey Association of Nurse Anesthetists will be held at the Berkeley-Carteret Hotel, Asbury Park, New Jersey, on May 14, 1941, closing with a banquet. All members are urged to be present.

For further information write Mrs. Dorothy Calder Ball, Secretary-Treasurer, 157 North 10th Avenue, Highland Park, N. J.

PENNSYLVANIA

The tenth annual convention of the Pennsylvania Association of Nurse Anesthetists was held at the Bellevue-Stratford Hotel, Philadelphia, on April 16 and 17, 1941, in conjunction with the Hospital Association of Pennsylvania.

Rose G. Donavan, Mount Sinai Hospital, Philadelphia, presided at the afternoon session on Wednesday, April 16. Greetings were presented by Major Roger A. Greene, President of the Hospital Association of Pennsylvania and Superintendent of Pottsville Hospital, Pottsville; and by Helen Lamb, President of the American Association of Nurse Anesthetists, Barnes Hospital, St. Louis, Missouri. The following papers were read:

"Art of Anesthesia"
Temple Fay, M. D., Professor, Department of Neurology and Neurosurgery, Temple University Hospital, Philadelphia

"Nitrous Oxide and Divinyl Ether in Dental Surgery"
John P. Lubby, M. D., Associate Professor, Charge of Anesthesia, Evans Institute, University of Pennsylvania, Philadelphia

"Carbon Dioxide and Oxygen in the Treatment and Prevention of Anoxemia"
Edward W. Beach, M. D., Director, School of Anesthesia, Graduate Hospital, University of Pennsylvania, Philadelphia

"Anesthesia in Pulmonary Disease"
Frank W. Burge, M. D., F.A.C.P., Chairman, Board of Regents, American College of Chest Physicians;
Editor, Journal of Diseases of the Chest

Discussion by Joseph O. Keezel, M. D., Chief, Department of Anesthesia, Lankenau Hospital, Philadelphia

The morning session closed with the presentation of the awards in the contest which had been conducted by the Pennsylvania Association for students of Schools of Anesthesia in Pennsylvania, as follows:

The first prize of Ten Dollars, donated by Edith E. Abary, Harrisburg Hospital, Harrisburg, President of the Pennsylvania Association of Nurse Anesthetists, was awarded to Elsie W. Chisholm, Jewish Hospital, Philadelphia, for her paper "Anesthesia for Cardiac Cases."

The second prize of Five Dollars, donated by the Pennsylvania Association of Nurse Anesthetists, was presented to Emilie Jensen, also of Jewish Hospital, for a paper on "Carbon Dioxide in Anesthesia."

The following papers received honorable mention:

"Anesthetic Deaths," by Mildred M. Reed, Jewish Hospital, Philadelphia

"Spinal Anesthesia," by Clude Sturkie, Mercy Hospital, Pittsburgh

The papers were judged by the Educational Committee of the American Association of Nurse Anesthetists.

The contest will be continued for another year, Miss Edith Davis of Allentown Hospital, Allentown, donating $10 for a first prize and the Pennsylvania Association $5 for second prize.

On Thursday morning, April 17, a clinic was held at the Doctors' Hospital by George B. Thomas, M. D., of the School of Medicine, University of Pittsburgh, demonstrating various types of anesthetic agents, followed by a luncheon at the Doctors' Hospital.

Edwina M. Irons, Protestant Episcopal Hospital, Philadelphia, presided

at the afternoon session on Thursday, and the following papers were presented:

"The Value of Helium in the Prevention of Explosions of Anesthetic Mixtures"
George B. Thomas, M. D., Instructor of Anesthesia, School of Medicine, University of Pittsburgh

"Practical Demonstration of the Combustibility of Various Gases"
David Labowitz, Ph. G., Medicinal Oxygen Company, Pittsburgh

"Cyclopropane"
Frederick P. Haugen, M. D., Chief Anesthetist, Presbyterian Hospital, Philadelphia

"Treatment of Tetanus with Avertin"
Edward T. Crossan, M. D., Chief Surgeon, Protestant Episcopal Hospital, Philadelphia

"Spinal Anesthesia"
William Lemmon, M. D., Assistant Professor of Surgery, Jefferson Medical College, Philadelphia

The annual banquet with the Hospital Association of Pennsylvania was held on Thursday evening, in the Ballroom of the Bellevue-Stratford Hotel, with Major Roger A. Greene presiding.

Report of Secretary

Members in good standing April 1, 1940		220
Members in good standing April 1, 1941		227
Delinquent members:		
April 1, 1940	56	
April 1, 1941	54	
Resignations	4	
Members transferred to Penna. Ass'n	10	
Members transferred from Penna. Ass'n	22	
New members	25	
Total membership April 1, 1941 (including delinquent members)		281
Applications pending		6
Correspondence—pieces mailed		1743
Correspondence—pieces received		520
Bills mailed out October 1, 1940		266
Bills mailed April 1, 1941		102

Report of Treasurer

Cash in Bank April 1, 1940		$1406.03
Receipts		
Dues	$1624.00	
Initiation fees	60.00	
Dues received from the American Association for members transferred to the Pennsylvania Association of Nurse Anesthetists	9.25	
Dues overpaid	2.00	1695.25
		$3101.28

Disbursements

Remittances to American Association of Nurse Anesthetists:		
Dues	$1096.75	
Initiation fees	62.00	
Initiation fee refunded	2.00	
Prize for contest	5.00	
Office expense	118.94	
Fidelity Bond premium for Sec'y-Treas.	5.00	
Convention expense	227.59	1517.28
Cash in Bank March 31, 1941		$1584.00
Represented by:		
Balance on deposit at the Central-Penn National Bank	$ 784.00	
Balance on deposit in the Philadelphia Saving Fund Society	800.00	$1584.00

Respectfully submitted,

HELEN YOUNG WALKER, Sec'y-Treas.

It was voted to contribute One Hundred Dollars toward the work of the Educational Committee of the American Association of Nurse Anesthetists.

Officers elected:

President	Edith Davis Allentown Hospital, Allentown
Second Vice-President	Margaret M. Degutis Pottsville Hospital, Pottsville
Trustees (1942-43-44)	Ida McK. Emerick Rochester General Hospital, Rochester
Historian	Edith E. Abary Magdalene Suter Grace Spangler

NEW YORK

PROGRAM

EIGHTH ANNUAL CONVENTION

New York Association of Nurse Anesthetists

Held in conjunction with the New York State Hospital Association

Hotel Pennsylvania, New York City

May 21-23, 1941

All sessions will be held in the Salon Moderne, 18th Floor
Registration desk open each day from 9:00 A.M. to 5:00 P.M.
and on Thursday evening, May 22, to 9:00 P.M.

Tuesday, May 20

8:00 P.M.

Meeting of the Board of Trustees at Hotel Pennsylvania

Wednesday, May 21

9:00 A.M.

Registration and Visiting Exhibits

GENERAL SESSION

10:00 A.M.

Elsa E. Franke Presiding
Schenectady, N. Y.

Greetings from the New York State Hospital Association
Frederick MacCurdy, M.D., President

Greetings from the New York Association of Nurse Anesthetists
Frances Hess, President
Director, Long Island College Hospital School of Anesthesia, Brooklyn

Address
Mary Ellen Manley, R.N.
Director, Nursing Division, Department of Hospitals, New York City

"The Part Nurse Anesthetists Can Take in the National Defense Program"
Ethel G. Prince, R.N.,
Past President, New York State Nurses' Association

"The Relationship of the Surgeon and the Anesthetist"
Frederic W. Bancroft, M.D., F.A.C.S.
Consulting Surgeon at the Veterans' Administration Facility Hospital, New York City, and at Lincoln, Kings' Park, and Harlem Hospitals; Director of Surgery, Beth David Hospital
Surgeon, New York City Hospital

"Methods of Controlling Fire and Explosion Hazards in the Operating Room"
Lewis H. Wright, M.D.,
Anesthesia Division, E. R. Squibb & Sons, New York City

"The Problem of Anesthesia in Oral Surgery"
William A. Fennelly, D.D.S., Associate Visiting Dentist, Bellevue Hospital, New York City; Consultant in Oral Surgery, Mary Immaculate Hospital, Jamaica, L. I., N. Y.; Clinical Professor of Oral Surgery, College of Dentistry, New York University

GENERAL SESSION

2:00 P.M.

Cora McKay Presiding
Past President, New York State Association of Nurse Anesthetists
Albany Hospital, Albany, N. Y.

Invocation
The Right Rev. William T. Manning, D.D., Bishop of New York

Address of Welcome

E. A. Rovenstine, M.D., Professor of Anesthesia, New York University College of Medicine; Director, Division of Anesthesia, Bellevue Hospital

(Representing The Honorable F. H. LaGuardia, Mayor of the City of New York)

Address

Helen Lamb, President, American Association of Nurse Anesthetists
Director, School of Anesthesia, Barnes Hospital, St. Louis, Missouri

"Anesthesia for the Diabetic Patient"

Irving N. Pallin, M.D.
Director of Anesthesia, Manhattan General Hospital, New York City

"Anesthesia, Analgesia, and Amnesia in Labor, and the Toxemias of Pregnancy, Including Cesarean Section"

Robert J. Lowrie, M.D., F.A.C.S.
Obstetrician, St. Vincent's Hospital, New York City
Associate Obstetrician, New York City Hospital

"Atelectasis, Asphyxia and Resuscitation in the New Born"

Mortimer Rodgers, M.D., F.A.C.S.
Associate Attending Obstetrician and Gynecologist, Lenox Hill Hospital, New York City;
Associate Attending Obstetrician, New York City Hospital

"Anesthesia for Major Abdominal Operations"

Boris Rapoport, M.D., F.I.C.A.,
Director, Department of Anesthesia, New York Hospital for Joint Diseases, New York City

"My Experiences with Spinal Anesthesia"

Harry Koster, M.D., F.A.C.S.
Crown Heights Hospital, Brooklyn

Banquet — Georgian Room, Hotel Pennsylvania

7:30 P.M.

Thursday, May 22

GENERAL SESSION

9:00 A.M.

Miriam G. Shupp Presiding
Past President, American Association of Nurse Anesthetists
Strong Memorial Hospital, Rochester, N. Y.

"Helping England to Prevent Asphyxial Death"

Paluel J. Flagg, M.D. President of the Society for the Prevention of Asphyxial Death; Chairman of the Committee on Asphyxia of the American Medical Association; Anesthetist, Manhattan Eye, Ear and Throat Hospital, New York City; Consulting Anesthetist: Woman's, St. Vincent's, Jamaica, Nassau, St. Joseph's, Mt. Vernon, and Mary Immaculate Hospitals.

"Anesthesia in Patients with Heart Disease"
(illustrated with slides)
Paul K. Sauer, M.D., F.A.C.S.
Associate Surgeon, Lenox Hill Hospital, and
Visiting Surgeon, New York City Hospital

"Anesthesia in Neurosurgery"
John E. Scarff, M.D., Associate Neurosurgeon, The Neurological Institute of New York, and the Vanderbilt Clinic, New York City

"Anesthesia in China"
Helen M. Holland, Peking Union Medical College,
Under China Medical Board of Rockefeller Foundation

"Anesthesia for a Tonsil Patient, as Used in the Tonsil Hospital"
Mary B. Wood, The Tonsil Hospital, New York City

GENERAL SESSION

2:00 P.M.

Ethel C. Burch Presiding
Columbus Hospital, New York City

"Indications for the Use of Chloroform Anesthesia"
Alden W. Squires, M.D., Director of Anesthesia,
Memorial Hospital, New York City

"The Anesthesia of Choice in Plastic Surgery"
I. Daniel Shorell, M.D., Plastic Surgeon

"Anesthesia in a Specialty Hospital from the Viewpoint of an Eye Surgeon"
Raymond Emory Meek, M.D.
Senior Assistant Surgeon, New York Eye and Ear Infirmary;
Instructor in Ophthalmic Surgery, New York University;
Attending Ophthalmologist, New York City Hospital;
Director, Second Eye Service, French Hospital, New York City

"Anesthesia in Dental Surgery"
(illustrated with motion pictures)
Harry M. Seldin, D.D.S., F.I.C.D., F.I.C.A.
Consulting Oral Surgeon, Harlem Hospital, New York City;
Consulting Oral Surgeon, New York Cancer Institute

"Intravenous Anesthesia and Analgesia"
(illustrated with slides)
Barnett A. Greene, M.D.
Director, Department of Anesthesia, Prospect Heights Hospital,
Chairman, Committee on Anesthetic Hazards and Co-Chairman of the Research Committee of the American Society of Anesthetists

"Intravenous Pentothal Sodium Anesthesia for General Surgery"
(motion picture)
Abbott Laboratories, New York City
Discussed by Elsa E. Franke, Anesthetist to F. F. McGauley, M.D., Schenectady, N. Y.

GENERAL SESSION

7:00 P.M.

Sara R. Mullin Presiding
The New York Hospital, New York City

"Autonomic Reflexes during Surgical Anesthesia"
Charles L. Burstein, M.D.
Department of Anesthesia, New York University College of Medicine; Director of Anesthesia, Hospital for the Ruptured and Crippled, New York City

"Advances in Inhalational Therapy, Including the Use of Oxygen, Helium, and the Administration of Atmospheric Gases under Various Types of Pressure"
(illustrated with motion pictures)
Alvan L. Barach, M.D.
Assistant Professor of Clinical Medicine, Columbia College of Physicians and Surgeons; Assistant Attending Physician, Presbyterian Hospital, New York City

"Anesthesia in Urologic Surgery"
Rose H. André, M.D.
Anesthetist, James Buchanan Brady Foundation, The New York Hospital

"Anesthesia for Tuberculous Patients"
Sara Bass, M.D.
Diplomate of American Board of Anesthesiology; Anesthetist, Lenox Hill Hospital, New York City

"What the Otolaryngologist Expects of the Anesthetist"
David Ide, M.D.
Associate Attending, Welfare Hospital, New York City; and New York City Hospital

"Preliminary Report of Trendelenburg Posture on the Circulation"
Vincent P. Mazzola, M.D.
Associate Attending Obstetrician and Gynecologist, Long Island College Hospital, Brooklyn

Friday, May 23

7:00 A.M. to 12:00 P.M.

Clinics:

Hospital for the Ruptured and Crippled, 321 East 42nd Street
"Anesthesia in Orthopedic Surgery"
"Spine Fusions in the Big Risser Jackets"
et cetera
Charles L. Burstein, M.D., Director of Anesthesia

Cancer Memorial Hospital, 444 East 68th Street
"Chloroform and Intratracheal Anesthesia"
Alden W. Squires, M.D., Director of Anesthesia

Bellevue Hospital, First Avenue and 26th Street
E. A. Rovenstine, M.D., Director, Division of Anesthesia;
Professor of Anesthesia, New York University College of Medicine

Woman's Hospital, 141 West 109th Street
Raymond C. Coburn, M.D., Director of Anesthesia

Luncheon

12:30 P.M.

Georgian Room, Hotel Pennsylvania

Prize Drawing

2:00 P.M.

BUSINESS SESSION

Frances Hess, Presiding
President, New York State Association of Nurse Anesthetists

Roll Call

Reports—

President — Frances Hess
Secretary — Alice M. Racette
Treasurer — May A. Danaher
Historian — Pauline Lapinski
Committees —
Membership — Gertrude Steffen
Nominating — Cora McKay

Election of Officers

Round Table
Grace G. Hughes presiding
Woman's Hospital, New York City

Introduction of New Officers

Meeting, Board of Trustees

Chairman, Program and Hospitality Committees,
Helen K. Craven, New York City Hospital

Chairman, Arrangements Committee
Janet B. Dougan, Morrisania Hospital, New York City

MASSACHUSETTS

ELIZABETH F. SPAULDING
President

A meeting of the Massachusetts Association was held the evening of February 24, 1941, with eleven members and two guests in attendance, Mrs. Elizabeth Spaulding, President, presiding.

Following the report of the Secretary-Treasurer, Mrs. Spaulding discussed the trip she made to Worcester, Massachusetts, with Miss Gertrude Gerrard, of Peter Bent Brigham Hospital, Boston, in connection with the survey of the Schools of Anesthesia being conducted by the American Association of Nurse Anesthetists.

Mrs. Guthloe Wilson, of London, England, gave a most interesting talk on her experiences in England before and during the present war, and incidents in her nursing work in China, Japan and India.

Plans were completed for a meeting to be held in May with a tea at the Ritz-Carlton. For further particulars write Miss Betty E. Lank, Secretary-Treasurer, 300 Longwood Avenue, Boston, Massachusetts.

GEORGIA

The Georgia Association of Nurse Anesthetists held it annual meeting in New Orleans, La., April 17-18, 1941, in conjunction with the Southeastern Assembly of Nurse Anesthetists.

Officers Elected:

President	Caroline Hohenschutz, St. Joseph's Infirmary, Atlanta
Vice-President	Jean McGinty, Elbert County Hospital, Elberton
Secretary-Treasurer	Clara Mahoney, Crawford Long Hospital, Atlanta
Trustees	Rosalie C. McDonald Billie Caraway Leola Vickers
Membership Committee	Mrs. Beata Clark, Chairman Miss Mabel Stott Miss Anita Benteen

TEXAS

The Texas Association held its sixth annual meeting at the Adolphus Hotel, Dallas, Texas, on February 27 and 28, 1941, in conjunction with the Texas Hospital Association. Program in full was published in the February, 1941, issue of the Bulletin.

At a joint session with the Texas Hospital Association Dr. Joseph C. Doane, Professor of Clinical Medicine, Temple University, Philadelphia, led an active discussion of hospital problems for all groups.

MINNIE V. HAAS
President

Officers Eected

President
Minnie V. Haas
907 East Ramsey, Fort Worth

Vice-President
Jean Vetesk
1601 Monroe, Amarillo

Secretary-Treasurer
Mrs. Jack K. Childress
716 West Avenue G, Temple

Historian
Sallie F. Knight
Baylor University Hospital, Dallas

Trustees

3-year	Osa Beck
2-yeai	Vergie Rape Kennedy
2-year	Marcella A. Cable
1-year	Velma Goode Thompson

NOTICE
ASSOCIATION PIN

Requests for the new Association pin are constantly coming in to headquarters. The pins are not yet available. When they are ready a notice will appear in the Bulletin.

NOTICE

The Instructors' Session, to be held at the annual meeting of the American Association of Nurse Anesthetists in Atlantic City, has been arranged tentatively for Wednesday morning, September 17, 1941.

The Educational Committee requests that questions for discussion be sent to Sister Rudolpha, St. John's Hospital, Springfield, Illinois, who will preside at this session.

TENNESSEE

The Tennessee Association of Nurse Anesthetists held its annual meeting at the Hotel Peabody, Memphis, Tenn., on February 12 and 13, 1941, in conjunction with the Mid-South Post Graduate Nurse Anesthetists Assembly. The following officers were elected:

BESSIE CALDWELL
President

President
Bessie Caldwell
Takoma Hospital and Sanitarium, Greeneville

First Vice-President
Ruthie E. Hawn
Crisler Clinic, Memphis

Second Vice-President
Minnie E. Swetman
U. S. Marine Hospital, Memphis

Secretary-Treasurer
Theresa W. Trail
615 North Willett St., Memphis

Historian
Betty J. Gilmore
Gartley-Ramsay Hospital, Memphis

Trustees
4-year Arline S. Johnson
3-year Antoinette La Rose Rossi
2-year Ethel Sellers
1-year Marion Martiel Sharpe

PROGRAM

Anesthetists of Illinois, Indiana, Michigan and Wisconsin

JOINT MEETING

Held in conjunction with the Tri-State Hospital Assembly

Stevens Hotel, Chicago

May 7-8, 1941

Wednesday, May 7

Registration — Exhibition Hall

9:00 A.M.

GENERAL SESSION

2:00 P.M.

South Ball Room, Third Floor

Thelma Deane, Logansport, Indiana, Presiding

Greetings:

Malcolm T. MacEachern, M.D., Chicago
Associate Director, American College of Surgeons
Chairman, Program Committee, Tri-State Hospital Assembly

Nelle G. Vincent, Evanston Hospital, Evanston, Illinois
President, Illinois Association of Nurse Anesthetists

Anna Willenborg, Chicago
Executive Secretary, American Association of Nurse Anesthetists

"The Prevention of Postanesthetic Complications"
Samuel Rosenthal, M.D.
St. Joseph Hospital, Milwaukee

"Nembutal and Barbiturates in Obstetrical Analgesia and Anesthesia"
W. C. Danforth, M.D., F.A.C.S.
Professor Obstetrics and Gynecology, Northwestern University Medical School; Chief, Department Obstetrics and Gynecology, Evanston Hospital, Evanston, Illinois.

"Physical Chemistry in Anesthesia"
Robert E. Dyer, M.D., F.A.C.S., Ravenswood Hospital, Chicago

"The Use of Cortical Extract in Anesthesia"
Sister Bernadette, St. Joseph's Hospital, Milwaukee

Banquet — South Ball Room, Stevens Hotel

7:00 P.M.

Invocation

Introduction of Guests

Music

Toastmaster — J. J. Moore, M.D.

Guest Speaker — Merritt La Count Jones, M.D., F.A.C.S.
Surgeon in Chief, Wausau Memorial Hospital, Wausau, Wisconsin

Thursday, May 8

Registration and Visiting Exhibits — Exhibition Hall

10:00 A.M.

GENERAL SESSION

2:00 P.M.

South Ball Room, Third Floor

Mable E. Courtney Presiding
Grace Hospital, Detroit
President, Michigan Association of Nurse Anesthetists

"Surgery and Anesthesia in Diabetics"
Crosby D. Eaton, M.D.
Diabetic Clinic, Grace Hospital, Detroit

"Anesthesia for Infants and Children in Plastic Surgery"
Esther Mason, First Assistant to Reuben Mauritis, M.D.,
Attending Anesthetist, Blodgett Hospital, Grand Rapids, Michigan

"Anesthesia in Surgery of the Nervous System"
A. Verbrugghen, M.D., F.A.C.S.,
Presbyterian Hospital, Chicago

"Responsibility of the Nurse Anesthetist in Spinal Anesthesia"
Richard L. Hane, M.D.
St. Joseph's and Episcopal Hospital, Fort Wayne, Indiana

"Cyclopropane Anesthesia in Obstetrics"
Garwood C. Richardson, M.D.
Associate in Obstetrics at Northwestern University Medical School, Chicago

BUSINESS MEETINGS

4:30 P.M.

Illinois Association of Nurse Anesthetists
Indiana Association of Nurse Anesthetists
Michigan Association of Nurse Anesthetists
Wisconsin Association of Nurse Anesthetists

7:00 P.M.

Banquet — Tri-State Hospital Assembly
Anesthetists are invited to attend

Friday, May 9

GENERAL SESSION

2:00 P.M.

South Ball Room —Third Floor
Esther E. Edwards Presiding
Wausau Memorial Hospital, Wausau, Wisconsin

"Convulsions during Anesthesia" with slides
Hartley F. Mars, M.D., Chicago

"Chest Complications Following Surgery" with slides
Conrad R. Lam, M.D., Associate in Surgery, and Ethel M. Moir
Henry Ford Hospital, Detroit

"Nurse Anesthetists in the Army"
Captain Pearl C. Fisher, Chicago
Assistant Superintendent, Army Nurse Corps

Round Table
Conducted by Mae B. Cameron, Ravenswood Hospital, Chicago

For further information write Mrs. Mae B. Cameron, Ravenswood Hospital, Chicago, Chairman, Tri-State Nurse Anesthetist Assembly

PROGRAM

The Mid-West Assembly of Nurse Anesthetists

Held in conjunction with the Mid-West Hospital Association

Hotel President, Kansas City, Missouri

April 24, 1941

GENERAL SESSION

10:00 A.M.

Ann Cox Presiding
President, Mid-West Assembly of Nurse Anesthetists

Reports of State Presidents:

Arkansas —
Colorado — Gladys Hoyt, Presbyterian Hospital, Denver
Kansas —
Missouri — Regina Noon, St. Louis
Nebraska — Wilhelmina Gulotta, Lincoln General Hospital, Lincoln
Oklahoma — Dixie Lee Diefenderfer, Wesley Hospital, Oklahoma City

Round Table
Conducted by Regina Noon, St. Louis

"Teamwork"
J. H. Robinson, M.D., Oklahoma City, Oklahoma

Luncheon

12:30 P.M.

"The Rôle of the Nurse Anesthetist in the Preparedness Program"
Helen Lamb, Guest Speaker
President, American Association of Nurse Anesthetists

GENERAL SESSION

2:00 P.M.

Dixie Lee Diefenderfer Presiding
Wesley Hospital, Oklahoma City, Oklahoma

"Anesthesia in Orthopedic Surgery—From the Surgeon's Viewpoint"
Frank D. Dickson, M.D., Kansas City, Missouri

"Anesthesia in Orthopedic Surgery—From the Anesthetist's Viewpoint"
Zelle Slasor, Kansas City, Missouri

"Anesthesia in Bronchoscopic Surgery"
Millard F. Arbuckle, M.D., F.A.C.S., St. Louis

BUSINESS SESSION

3:30 P.M.

Banquet — With Mid-West Hospital Association

PROGRAM

ANNUAL MEETING

Washington State Association of Nurse Anesthetists

Held in conjunction with the Washington State Hospital Association

Tacoma, Washington

April 25-26, 1941

Friday, April 25

GENERAL SESSION

10:00 A.M.

June C. Roberts, President, Presiding

Address of Welcome
Elsa A. Koski, President, Western Division

Response
Charlotte V. O'Neill, President, Eastern Division

President's Address — June C. Roberts

Reports—
Secretary
Treasurer
Historian
Committees

Luncheon

12:30 P.M.

Joint Meeting with the Washington State Hospital Association

GENERAL SESSION

2:00 P.M.

Invocation—The Reverend J. Renwich McCullough

Greetings—Mayor Cain of Tacoma

"The Neurologic Significance of the Signs of Anesthesia"
Joseph W. Lynch, M.D., Spokane

Discussion

"The Prevention of Fetal Anoxemia Under Anesthesia"
Elizabeth A. Scully, Deaconess Hospital, Spokane

Reception

5:30-6:30 P.M.

Banquet — with Washington Hospital Association

7:00 P.M.

Saturday, April 26

Breakfast — Winthrop Hotel

8:00 A.M.

Report of San Francisco Convention

Nan Rowlands, Seattle

Joint Meeting with Washington Hospital Association

9:00 A.M.

"The Nurse Anesthetist — Her Responsibility and Liability"

Rose O'Neill, Columbus Hospital, Seattle

Business Meeting and Election of Officers

10:30 A.M.

Red, White and Blue Luncheon

in Army and Navy Room, Winthrop Hotel

12:00 noon

Scenic Drive

3:00 P.M.

Buffet Supper

7:00 P.M.

SOUTHEASTERN ASSEMBLY OF NURSE ANESTHETISTS

Ninety-four anesthetists, representing five member states and nine other states, were registered at the third annual meeting of the Southeastern Assembly of Nurse Anesthetists, held in New Orleans April 17-19, 1941, in conjunction with the Southeastern Hospital Conference.

The program was published in the February issue of the Bulletin, and the following also spoke to the group:

Dr. B. W. Black, President of the American Hospital Association.

Dr. Bert W. Caldwell, Executive Secretary of the American Hospital Association.

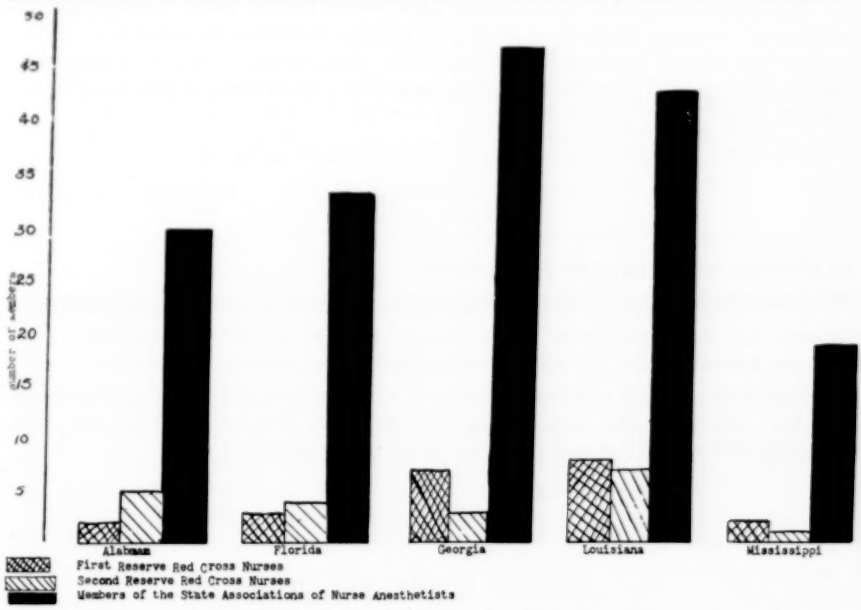
Major P. A. Brickey, Chief Surgeon, La Guarde Army Hospital, New Orleans.

Dr. John Adriani, Charity Hospital, New Orleans, whose paper entitled "Recent Developments in Carbon Dioxide Absorption" appears on page 86 this issue.

A constitution and by-laws submitted by the Revisions Committee was adopted by the members of the Assembly. The President will be elected by the members, and the Board of Directors, consisting of the State Presidents, will appoint the Secretary-Treasurer.

The social activities included a doughnut and coffee breakfast at Charity Hospital; a luncheon at which the Charity Hospital students gave a play entitled "Morpheus' Daughters"; and two teas—one arranged by the Sisters of Charity at Hotel Dieu, the other by Jeanne Robichaux and Mattie Word. A moonlight boat trip was arranged, and a tour of the city was given by the Louisiana Association.

The fourth annual meeting will be held in Memphis, Tennessee in 1942. Esther C. Myers, of Charity Hospital, New Orleans, was re-elected President, and Ida Tedford Ellis, Orange General Hospital, Orlando, Florida, was appointed to continue to serve as Secretary-Treasurer.



First reserve nurses are subject to first call. Second reserve nurses are those who are over 40 years of age or married and are subject to second call.

At the time of this study (January 1941) there were 172 nurse anesthetists in the Southeastern Assembly. Of that membership 22 were first reserve Red Cross nurses or 13 per cent; 19 were second reserve Red Cross nurses or 11 per cent. Of the 172 members, 41 (or 30 per cent) were Red Cross nurses.

LOUISIANA

At the annual meeting of the Louisiana Association of Nurse Anesthetists, held in New Orleans, April 17-18, 1941, in conjunction with the Southeastern Assembly of Nurse Anesthetists, the following officers were elected:

President	O. Rowene Kling 632 Maison Blanche Bldg., New Orleans
First Vice-President	Mary Sim 4612 Banks St., New Orleans
Second Vice-President	Rosalie G. Sullivan 415 Codifer Avenue, Metairie, New Orleans

Secretary	Jeanne Robichaux 1124 Maison Blanche Bldg., New Orleans
Treasurer	Mattie T. Word 1410 St. Andrew St., New Orleans
Historian	Mrs. Sam Owen State Charity Hospital, Shreveport
Trustee	Betty Tomeny 4921 Carondelet St., New Orleans

ALABAMA

The Alabama Association of Nurse Anesthetists held a dinner meeting on the evening of January 20, 1941, at Highland Terrace Gardens, Birmingham. A report of the annual meeting of the American Association of Nurse Anesthetists held in Boston was given by Miss Stephanie Foto, St. Vincent's Hospital, Birmingham.

ALUMNAE ASSOCIATION ORGANIZES

On Friday, April 18, 1941, in the Mirror Room of the Jung Hotel, New Orleans, La., thirty graduates of the Charity Hospital School of Anesthesia, New Orleans, assembled for the purpose of organizing an Alumae Association.

Miss Maria Garcia, of Charity Hospital, who had called the meeting, presided, and the report of the Constitution and By-Laws Committee, read by Miss Elizabeth Coleman, Chairman, was accepted unanimously.

Officers Elected:

President:
Lillian M. Gebs,
Charity Hospital, New Orleans, La.

Vice-President:
Margie Boyles,
Highland Baptist Hospital, Birmingham, Ala.

Secretary:
Elizabeth Coleman,
8133 Spruce St., New Orleans, La.

Treasurer:
Rosalie G. Sullivan,
415 Codifer Ave., Metaire, New Orleans, La.

Historian:
Ruth Perry Glass,
Methodist Hospital, Hattiesburg, Miss.

AMERICAN ASSOCIATION OF NURSE ANESTHETISTS

OFFICERS
1940-1941

President	Helen Lamb Barnes Hospital, St. Louis, Mo.
First Vice-President	Rosalie C. McDonald Emory University Hospital, Atlanta, Ga.
Second Vice-President	Rose G. Donavan Mount Sinai Hospital, Philadelphia, Pa.
Treasurer	Gertrude L. Fife University Hospitals, Cleveland, Ohio
Historian	Leone Myers Ravenswood Hospital, Chicago, Ill.

Trustees:

Helen Lamb, Chairman, Missouri
Rosalie C. McDonald, Georgia
Gertrude L. Fife, Ohio
Agatha C. Hodgins, Massachusetts
Miriam G. Shupp, New York
Louise E. Schwarting, Iowa
Lucy E. Richards, Ohio
Hazel Blanchard, New York

HEADQUARTERS: 18 East Division Street,
Chicago, Illinois
Anna Willenborg, Executive Secretary

In Memoriam

Mary Hoen Muller died on January 22nd, 1941, after a brief illness, at Duke University Hospital, Durham, North Carolina.

Miss Muller was graduated from the Hospital for the Women of Maryland, Baltimore. After completing a course in anesthesia at Johns Hopkins Hospital in 1926, she remained there as a member of the anesthesia staff until 1930, when she resigned to organize a Department of Anesthesia at Duke University Hospital, holding the position of Anesthetist in Chief until her death.

Miss Muller became a member of the American Association of Nurse Anesthetists in 1934, later serving on the Educational Committee. Miss Muller was keenly interested in higher standards of teaching in the schools of anesthesia throughout the country. Her school at Duke University Hospital is an outstanding example of her ability and vision.

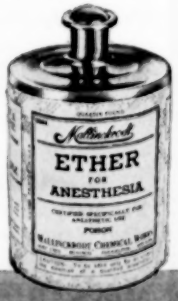
The Association has lost a loyal and valuable member; we, the alumnae of the Johns Hopkins School of Anesthesia, a true friend.

—OLIVE L. BERGER

Miss Ida Luella Espe, a member of the Association since 1933, died February 3, 1941. Miss Espe was graduated from the St. Luke's Hospital School of Nursing, Spokane, Washington, in 1927, and from the University Hospitals of Cleveland, Ohio, School of Anesthesia on January 1, 1933. She had been employed at St. Luke's Hospital, Spokane, and Swedish Hospital, Seattle, Washington.

An Aseptic Field . . .
A Sure Hand . . .
A Reliable Anesthetic

When the anesthetic bears the Mallinckrodt label, surgeons, anesthetists and doctors can place implicit reliance in its performance. Modern as the newest shadowless operating lights, Mallinckrodt anesthetics are products of thousands upon thousands of research hours. Successful use in millions of operative procedures attests their uniform efficiency, purity and stability. Before release, every Mallinckrodt anesthetic is subjected to careful chemical analysis as a *final check* of its purity and uniformity.



MALLINCKRODT ETHER for Anesthesia

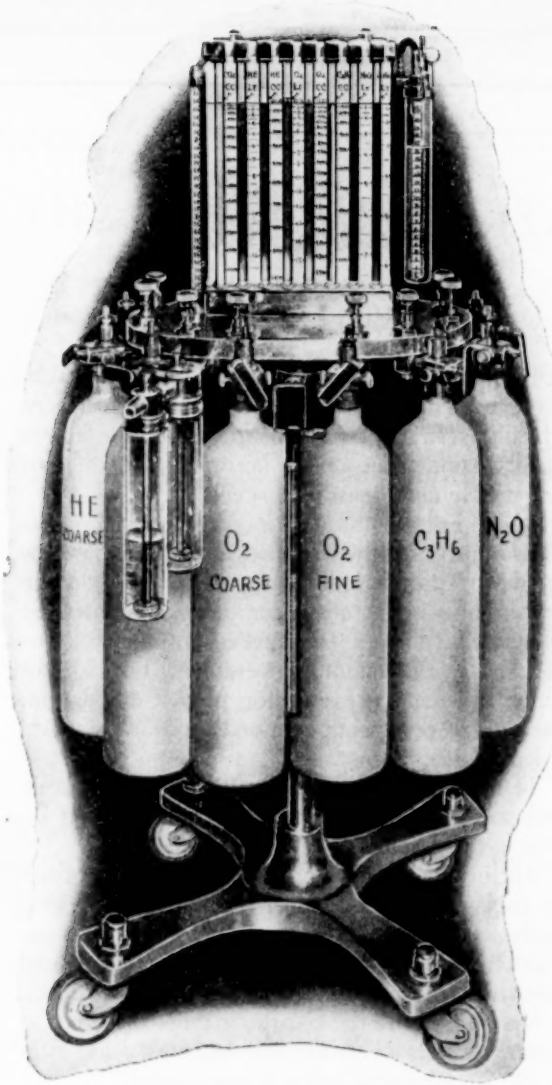
Other Widely Used Mallinckrodt Anesthetics

Procaine Hydrochloride U.S.P. XI
MALLINCKRODT Cyclopropane* U.S.P. XI
Paraldehyde U.S.P. XI
Chloroform U.S.P. XI for Anesthesia

* Cyclopropane (Mallinckrodt) may also be obtained through the various offices of the Puritan Compressed Gas Corporation of Kansas City.

MALLINCKRODT CHEMICAL WORKS

St. Louis New York Philadelphia Chicago Montreal Toronto



8 Flowmeter Unit

With the following correctly calibrated flowmeters

Helium fine ....max. 1000 cc.	Cyclopropane ..max. 1000 cc.
Helium coarse ..max. 12½ Lt.	Nitrous Oxide ..max. 8 Lt.
Oxygen fine ....max. 1900 cc.	Ethylene .....max. 6 Lt.
Oxygen coarse .max. 15 Lt.	Carbon Dioxide max. 1500 cc.

"Used with eminent satisfaction for more than a year in the thoracic surgery clinic of Dr. Evarts A. Graham at Barnes Hospital, St. Louis."

THE FOREGGER COMPANY

New York, N. Y.

Note.—Conductive rubber tires, breathing bags, tubings, etc., now available for your Foregger equipment.

Ether Squibb

MUCH THOUGHT AND CARE IN ITS MAKING

E. R. Squibb & Sons make but one quality of ether —the best for anesthesia. The thought and care which govern its preparation are important factors in the maintenance of the unsurpassed quality of this widely used anesthetic agent.

Squibb Ether is made by a continuous steam distillation process which ensures maximum uniformity during production. Every critical step in the process of manufacture is automatically controlled by sensitive devices—the rate of flow of the alcohol, the regulation of temperatures, the maintenance of steam pressure for proper distillation. Each detail represents care and thought to assure a dependable product.

The avoidance of the formation of oxidative products during manufacture is important. At no time is the ether exposed to the atmosphere.

The original purity of Squibb Ether is maintained by packaging it in a copper-lined container—used exclusively by Squibb to prevent formation of unwanted oxidative products, such as peroxides and aldehydes whose presence may produce toxic effects.

Squibb Ether is the anesthetic ether of choice in many hospitals where the potency, purity and safety of this anesthetic agent is appreciated.

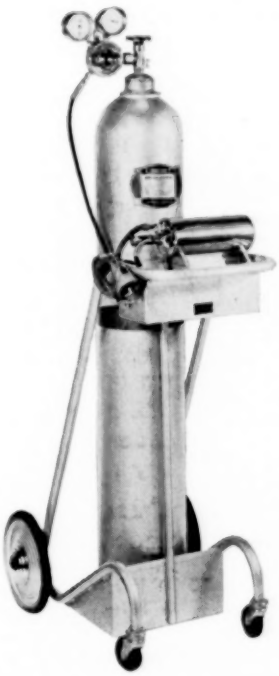
For literature address the Anesthetic Division,
E. R. Squibb & Sons, 745 Fifth Ave., N. Y.

SQUIBB ETHER

Made, Tested and Packaged only in the Squibb Laboratories

Introducing

THE DANN RESUSCITATOR



A complete unit
for administering
artificial respiration

Compact,
Mobile

Easy to operate
Instantly adaptable
to infants or adults

Complete data and demonstration upon request

The CHENEY Chemical Co.

2829 East 67th Street, CLEVELAND, OHIO

Anesthetic and Resuscitating Gases

Branches in Principal Cities